2023 CFA®
Exam Prep

Schweser's Secret Sauce®

LEVEL II

KAPLAN SCHWESER

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Level II CFA®

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Schweser's Secret Sauce®: 2023 Level II CFA®

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FOREWORD

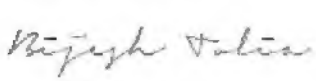
Secret Sauce® offers concise and readable explanations of the major ideas in the Level II CFA curriculum.

This book does not cover every Learning Outcome Statement (LOS) and, as you are aware, any LOS is "fair game" for the exam. We focus here on those LOS that are core concepts, have application to other LOS, are complex and difficult for candidates, or require memorization of characteristics or relationships.

Secret Sauce is easy to carry with you and will allow you to study these key concepts, definitions, and techniques over and over, an important part of mastering the material. When you get to topics where the coverage here appears too brief or raises questions in your mind, this is your cue to go back to your **SchweserNotes** to fill in the gaps in your understanding. There is no shortcut to learning the vast breadth of subject matter covered by the Level II curriculum, but this volume will be a valuable tool for reviewing the material as you progress in your studies over the months leading up to exam day.

Pass rates remain well under 50%, and returning Level II candidates make comments such as, "I was surprised at how difficult the exam was." You should not despair because of this, but more importantly do not underestimate the challenge. Our study materials, mock exams, question bank, videos, classes, and Secret Sauce are all designed to help you study as efficiently as possible, grasp and retain the material, and apply it with confidence on exam day.

Best regards,



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QUANTITATIVE METHODS

Topic Weight on Exam	5%–10%
SchweserNotes™ Reference	Book 1, Pages 1–113

Quantitative analysis is one of the primary tools used in the investment community, so you can expect CFA Institute to test this section thoroughly.

Multiple regression and machine learning are key topics for the Level II exam. For the time series material, the concepts of nonstationarity, unit roots (i.e., random walks), and serial correlation, will be important, as well as being able to calculate the mean-reverting level of an autoregressive (AR) time-series model. Understand the implications of seasonality and how to detect and correct it, as well as the root mean squared error (RMSE) as a model evaluation criterion.

MULTIPLE REGRESSION

Cross-Reference to CFA Institute Assigned Reading #1

Multiple regression is a rather important part of the quant material.

You should understand the interpretation of a regression output, how a reduced versus a full model is evaluated using an *F*-test, and the impact of influential observations on the regression results. You should also understand the effect that heteroskedasticity, serial correlation, and multicollinearity have on regression results.

A regression of a dependent variable (e.g., sales) on three independent variables would yield an equation like the following:

Source	df (Degrees of Freedom)	SS (Sum of Squares)	MS (Mean Square = SS/df)
Regression	k	RSS	$MSR = \frac{RSS}{k}$
Error	$n - k - 1$	SSE	$MSE = \frac{SSE}{n - k - 1}$
Total	$n - 1$	SST	

Multiple Regression: Model Fit

ANOVA is a statistical procedure that attributes the variation in the dependent variable to one of two sources: the regression model or the residuals (i.e., the error term). The structure of an ANOVA table is shown in Figure 1.

Figure 1: Analysis of Variance (ANOVA) Table

Source	df (Degrees of Freedom)	SS (Sum of Squares)	MS (Mean Square = SS/df)
Regression	k	RSS	$MSR = \frac{RSS}{k}$
Error	$n - k - 1$	SSE	$MSE = \frac{SSE}{n - k - 1}$
Total	$n - 1$	SST	

Note that RSS + SSE = SST. The information in an ANOVA table can be used to calculate R^2, the *F*-statistics, and the standard error of estimate (SEE).

The *coefficient of determination* (R^2) is the percentage of the variation in the dependent variable explained by the independent variables.

$$R^2 = \frac{\text{regression sum of squares (RSS)}}{\text{total sum of squares (SST)}}$$

$$= \frac{\text{SST} - \text{sum of squared errors (SSE)}}{\text{SST}}$$

In multiple regression, you also need to understand *adjusted* R^2. The adjusted R^2 provides a measure of the goodness of fit that adjusts for the number of independent variables included in the model.

Akaike's information criterion (AIC) and **Schwarz's Bayesian information criterion (BIC)** are used to evaluate competing models with the same dependent variable. Lower values indicate a better model under either criteria. AIC is used if the goal is a better forecast, while BIC is used if the goal is a better goodness of fit.

$AIC = n \times \ln(SSE/n) + 2(k + 1)$

$BIC = n \times \ln(SSE/n) + \ln(n) \times (k + 1)$

where:

k = the number of independent variables

Joint Hypothesis Tests

Nested models comprise a full (or unrestricted) model, and a restricted model that uses "q" fewer independent variables. To test whether the "q" excluded variables add to the explanatory power of the model, we test the hypothesis:

$H_0: b_i = b_j = \ldots b_q = 0$

vs.

H_a: at least one of the slope coefficients of excluded variables $\neq 0$

We calculate the *F*-statistic to test this hypothesis as:

$$F = \frac{(SSE_R - SSE_U)/q}{SSE_U/(n - k - 1)} \text{ with q and } (n - k - 1) \text{ degrees of freedom}$$

where:

R and U represent the restricted and unrestricted models, respectively

q = number of excluded variables in the restricted model

k = number of independent variables in the unrestricted model

Decision rule: reject H_0 if F (test-statistic) > F_c (critical value)

Tests of all coefficients collectively. For this test, the null hypothesis is that all the slope coefficients simultaneously equal zero. The required test is a one-tailed F-test and the calculated statistic is:

$$F = \frac{\text{regression mean square (MSR)}}{\text{mean squared error (MSE)}} \quad \text{with k and n} - \text{k} - 1 \text{ df}$$

Rejection of the null hypothesis at a stated level of significance indicates that at least one of the coefficients is significantly different than zero, which is interpreted to mean that at least one of the independent variables in the regression model makes a significant contribution to the explanation of the dependent variable.

Potential Problems in Regression Analysis

You should be familiar with the three violations of the assumptions of multiple regression and their effects.

Figure 2: Violation of Regression Assumptions

Violation	Conditional Heteroskedasticity	Serial Correlation	Multicollinearity
What is it?	Residual variance is related to level of independent variables	Residuals are correlated with each other	Two or more independent variables are highly correlated
Effect?	Coefficients are consistent. Standard errors are underestimated. Too many Type I errors	Coefficients are consistent. Standard errors are underestimated. Too many Type I errors (positive correlation)	Coefficients are consistent (but unreliable). Standard errors are overestimated. Too many Type II errors
Detection?	Breusch–Pagan chi-square test	Breusch–Godfrey (BG) F-test	Conflicting t and F-statistics; high variance inflation factors (VIF)
Correction?	Use robust or White-corrected standard errors	Use robust or Newey–West corrected standard errors	Drop one of the correlated variables, or use a different proxy for an included independent variable

Model Misspecification

Figure 3 shows types of model misspecifications and their impact on the regression results.

Figure 3: Model Misspecifications

Misspecification	Description	Effect
Omission of important independent variable(s)	One or more variables that should have been included have been omitted	Biased and inconsistent regression parameters May lead to serial correlation or heteroskedasticity in the residuals
Inappropriate transformation	Linear model trying to fit nonlinear relationships	May lead to heteroskedasticity in the residuals
Inappropriate variable scaling	Variables are not transformed appropriately	May lead to heteroskedasticity in the residuals or multicollinearity
Data improperly pooled	Sample has periods of dissimilar economic environments (i.e., the slope coefficients are unstable)	May lead to heteroskedasticity or serial correlation in the residuals

Influence Analysis and Influential Data Points

Outliers are extreme observations of the dependent or "*Y*" variable, while high-leverage points are the extreme observations of the independent or "*X*" variables. **Influential data points** are extreme observations that when excluded cause a significant change in model coefficients. Influential data points cause the model to perform poorly out of sample.

Cook's D values greater than $\sqrt{k/n}$ indicate that the observation is highly likely to be an influential data point. Influential data points should be checked for input errors; alternatively, the observation may be valid but the model incomplete.

Qualitative Independent Variables

Qualitative independent variables (dummy variables) capture the effect of binary independent variables. When we want to distinguish between n classes, we must use (n – 1) dummy variables. Otherwise, we would violate the regression assumption of no exact linear relationship between independent variables.

A dummy variable can be an intercept dummy or a slope dummy or a combination of the two.

Logistic Regression Models

Qualitative dependent variables (e.g., bankrupt versus non-bankrupt) require methods other than ordinary least squares. **Logistic regression (logit) models** use log odds as the dependent variable, and the coefficients are estimated using the maximum likelihood estimation methodology. The slope coefficients in a logit model are interpreted as the change in the "log odds" of the event occurring per 1-unit change in the independent variable, holding all other independent variables constant.

TIME-SERIES ANALYSIS

Cross-Reference to CFA Institute Assigned Reading #2

Types of Time Series

Linear Trend Model

The typical time series uses time as the independent variable to estimate the value of time series (the dependent variable) in period *t*:

$$y_t = b_0 + b_1(t) + \varepsilon_t$$

The predicted change in y is b_1 and t = 1, 2, ..., T

Trend models are limited in that they assume time explains the dependent variable. Also, they tend to be plagued by various assumption violations. The Durbin-Watson test statistic can be used to check for serial correlation. A linear trend model may be appropriate if the data points seem to be equally distributed above and below the line and the mean is constant. Growth in GDP and inflation levels are likely candidates for linear models.

Log-Linear Trend Model

Log-linear regression assumes the dependent financial variable grows at some constant rate:

$$y_t = e^{b_0 + b_1(t)}$$

$$\ln(y_t) = \ln(e^{b_0 + b_1(t)}) \Rightarrow b_0 + b_1(t)$$

The log-linear model is best for a data series that exhibits a trend or for which the residuals are correlated or predictable or the mean is non-constant. Most of the data related to investments have some type of trend and thus lend themselves more to a log-linear model. In addition, any data that have seasonality are candidates for a log-linear model. Recall that any exponential growth data call for a log-linear model.

The use of the transformed data produces a linear trend line with a better fit for the data and increases the predictive ability of the model. Because the log-linear model more accurately captures the behavior of the time series, the impact of serial correlation in the error terms is minimized.

Autoregressive (AR) Model

In AR models, the dependent variable is regressed against previous values of itself.

An autoregressive model of order *p* can be represented as:

$$x_t = b_0 + b_1x_{t-1} + b_2x_{t-2} + \ldots + b_px_{t-p} + \varepsilon_t$$

There is no longer a distinction between the dependent and independent variables (i.e., *x* is the only variable). An AR(p) model is specified correctly if the autocorrelations of residuals from the model are not statistically significant at any lag.

When testing for serial correlation in an AR model, don't use the Durbin-Watson statistic. Use a *t*-test to determine whether any of the correlations between residuals at

any lag are statistically significant.

If some are significant, the model is incorrectly specified and a lagged variable at the indicated lag should be added.

Chain Rule of Forecasting

Multiperiod forecasting with AR models is done one period at a time, where risk increases with each successive forecast because it is based on previously forecasted values. The calculation of successive forecasts in this manner is referred to as the *chain rule of forecasting*. A one-period-ahead forecast for an AR(1) model is determined in the following manner:

$$\hat{x}_{t+1} = \hat{b}_0 + \hat{b}_1 x_t$$

Likewise, a 2-step-ahead forecast for an AR(1) model is calculated as:

$$\hat{x}_{t+2} = \hat{b}_0 + \hat{b}_1 \hat{x}_{t+1}$$

Covariance Stationary

Statistical inferences based on an autoregressive time series model may be invalid unless we can make the assumption that the time series being modeled is covariance stationary. A time series is covariance stationary if it satisfies the following three conditions:

1. Constant and finite mean.
2. Constant and finite variance.
3. Constant and finite covariance with leading or lagged values.

To determine whether a time series is covariance stationary, we can:

- Plot the data to see if the mean and variance remain constant.
- Perform the Dickey-Fuller test (which is a test for a unit root, or if $b_1 - 1$ is equal to zero).

If the times series does not satisfy these conditions, we say it is not covariance stationary, or that there is nonstationarity. Most economic and financial time series relationships are not stationary. The degree of nonstationarity depends on the length of the series and the underlying economic and market environment and conditions.

For an AR(1) model to be covariance stationary, the mean reverting level must be defined. Stated differently, b_1 must be less than one.

If the AR model is not covariance stationary, we can often correct it with first differencing.

Mean Reversion

A time series is mean reverting if it tends towards its mean over time. The mean reverting level for an AR(1) model is $\frac{b_0}{(1 - b_1)}$.

The value of the variable tends to fall when above its mean and rise when below its mean.

Unit Root

If the value of the lag coefficient is equal to one, the time series is said to have a unit root and will follow a random walk process. A series with a unit root is not covariance stationary. Economic and finance time series frequently have unit roots. First differencing will often eliminate the unit root. If there is a unit root, this period's value is equal to last period's value plus a random error term and the mean reverting level is undefined.

Random Walk

A random walk time series is one for which the value in one period is equal to the value in another period, plus a random (unpredictable) error. If we believe a time series is a random walk (i.e., has a unit root), we can transform the data to a covariance stationary time series using a procedure called first differencing.

Random walk without a drift: $x_t = x_{t-1} + \varepsilon_t$

Random walk with a drift: $x_t = b_0 + x_{t-1} + \varepsilon_t$

In either case, the mean reverting level is undefined ($b_1 = 1$), so the series is not covariance stationary.

First Differencing

The first differencing process involves subtracting the value of the time series in the immediately preceding period from the current value of the time series to define a new variable, y. If the original time series has a unit root, this means we can define y_t as:

$$y_t = x_t - x_{t-1} \Rightarrow y_t = \varepsilon_t$$

Then, stating y in the form of an AR(1) model:

$$y_t = b_0 + b_1 y_{t-1} + \varepsilon_t$$

where:

$b_0 = b_1 = 0$

This transformed time series has a finite mean-reverting level of $\frac{0}{1-0} = 0$ and is, therefore, covariance stationary.

First differencing can remove a trend in the data and result in a covariance stationary series.

PROFESSOR'S NOTE

By taking first differences, you model the *change* in the value of the variable rather than the value of the variable.

Seasonality

Seasonality in a time series is tested by calculating the autocorrelations of error terms. A statistically significant lagged error term may indicate seasonality. To adjust for

seasonality in an AR model, an additional lag of the variable (corresponding to the statistically significant lagged error term) is added to the original model. Usually, if quarterly data are used, the seasonal lag is 4; if monthly data are used, the seasonal lag is 12. If a seasonal lag coefficient is appropriate and corrects the seasonality, a revised model incorporating the seasonal lag will show no statistical significance of the lagged error terms.

Assessing Forecast Accuracy With Root Mean Squared Error (RMSE)

Root mean squared error (RMSE) is used to assess the predictive accuracy of autoregressive models. For example, you could compare the results of an AR(1) and an AR(2) model. The RMSE is the square root of the average (or mean) squared error. The model with the lower RMSE is better.

Out-of-sample forecasts predict values using a model for periods beyond the time series used to estimate the model. The RMSE of a model's out-of-sample forecasts should be used to compare the accuracy of alternative models.

Structural Change (Coefficient Instability)

Estimated regression coefficients may change from one time period to another. There is a trade-off between the statistical reliability of using a long time series and the coefficient stability of a short time series. You need to ask, has the economic process or environment changed?

A structural change is indicated by a significant shift in the plotted data at a point in time that seems to divide the data into two distinct patterns. When this is the case, you have to run two different models, one incorporating the data before and one after that date, and test whether the time series has actually shifted. If the time series has shifted significantly, a single time series encompassing the entire period (i.e., encompassing both patterns) will likely produce unreliable results, so the model using more recent data may be more appropriate.

Cointegration

Cointegration means that two time series are economically linked (related to the same macro variables) or follow the same trend and that relationship is not expected to change. If two time series are cointegrated, the error term from regressing one on the other is covariance stationary and the *t*-tests are reliable.

To test whether two time series are cointegrated, we regress one variable on the other using the following model:

$$y_t = b_0 + b_1 x_t + \varepsilon$$

where:

y_t = value of time series y at time t

x_t = value of time series x at time t

The residuals are tested for a unit root using the Dickey-Fuller test with critical *t*-values calculated by Engle and Granger (i.e., the DF-EG test). If the test *rejects* the null hypothesis of a unit root, we say the error terms generated by the two time series are covariance stationary and the two series are cointegrated. If the two series are cointegrated, we can use the regression to model their relationship.

Occasionally, an analyst will run a regression using two time series (i.e., two time series with different variables). For example, to use the market model to estimate the equity beta for a stock, the analyst regresses a time series of the stock's returns on a time series of returns for the market.

- If both time series are covariance stationary, model is reliable.
- If only the dependent variable time series or only the independent time series is covariance stationary, the model is not reliable.
- If neither time series is covariance stationary, you need to check for cointegration.

Autoregressive Conditional Heteroskedasticity (ARCH)

ARCH describes the condition where the variance of the residuals in one time period within a time series is dependent on the variance of the residuals in another period. When this condition exists, the standard errors of the regression coefficients in AR models and the hypothesis tests of these coefficients are invalid.

The ARCH(1) regression model is expressed as:

$$\hat{\varepsilon}_t^2 = a_0 + a_1 \hat{\varepsilon}_{t-1}^2 + \mu_t$$

If the coefficient, a_1, is statistically different from zero, the time series is ARCH(1).

If a time-series model has been determined to contain ARCH errors, regression procedures that correct for heteroskedasticity, such as generalized least squares, must be used in order to develop a predictive model. Otherwise, the standard errors of the model's coefficients will be incorrect, leading to invalid conclusions.

However, if a time series has ARCH errors, an ARCH model can be used to predict the variance of the residuals in following periods. For example, if the data exhibit an ARCH(1) pattern, the ARCH(1) model can be used in period t to predict the variance of the residuals in period t + 1:

$$\hat{\sigma}_{t+1}^2 = \hat{a}_0 + \hat{a}_1 \hat{\varepsilon}_t^2$$

Summary: The Time-Series Analysis Process

The following steps provide a summary of the time-series analysis process. Note that you may not need to go through all nine steps. For example, notice that by step C, if there is no seasonality or structural change and the residuals do not exhibit serial correlation, the model is appropriate.

Step A: Evaluate the investment situation you are analyzing and select a model. If you choose a time series model, follow steps B through I.

Step B: Plot the data and check that it is covariance stationarity. Signs of nonstationarity include linear trend, exponential trends, seasonality, or a structural change in the data.

Step C: If no seasonality or structural change, decide between a linear or log-linear model.

- Calculate the residuals.
- Check for serial correlation using the Durbin-Watson statistic.
- If no serial correlation, model is appropriate to use.

Step D: If you find serial correlation, prepare to use an auto regressive (AR) model by making it covariance stationary. This includes:

- Correcting for a linear trend—use first differencing.
- Correcting for an exponential trend—take natural log and first difference.
- Correcting for a structural shift—estimate the models before and after the change.
- Correcting for seasonality—add a seasonal lag (see step G).

Step E: After the series is covariance stationary, use an AR(1). model to model the data.

- Test residuals for significant serial correlations.
- If no significant correlation, model is okay to use.

Step F: If the residuals from the AR(1). exhibit serial correlation, use an AR(2). model.

- Test residuals for significant serial correlations.
- If no significant correlation, model is okay to use.
- If significant correlation found, keep adding to the AR model until there is no significant serial correlation.

Step G: Check for seasonality.

- Plot data.
- Check seasonal residuals (autocorrelations) for significance.
- If residuals are significant, add the appropriate lag (e.g., for monthly data, add the 12th lag of the time series).

Step H: Check for ARCH.

Step I: Test the model on out-of-sample data.

MACHINE LEARNING

Cross-Reference to CFA Institute Assigned Reading #3

Supervised Machine Learning, Unsupervised Machine Learning, and Deep Learning

The goal of machine learning is use data to automate decision-making.

- **Supervised learning.** Inputs and outputs are identified for the computer, and the algorithm uses this labeled training data to model relationships.
- **Unsupervised learning.** The computer is not given labeled data; rather, it is provided unlabeled data that the algorithm uses to determine the structure of the data.
- **Deep learning algorithms.** Algorithms such as neural networks and reinforced learning learn from their own prediction errors and are used for complex tasks such as image recognition and natural language processing.

Overfitting and Methods of Addressing It

In supervised learning, overfitting results from having a large number of independent variables (features), resulting in an overly complex model which may have generalized random noise that improves in-sample forecasting accuracy. However, overfit models do not generalize well to new data (i.e., low out-of-sample R-squared).

To reduce the problem of overfitting, data scientists use **complexity reduction** and **cross validation.** In complexity reduction, a penalty is imposed to exclude features that are not meaningfully contributing to out-of-sample prediction accuracy. This penalty value increases with the number of independent variables used by the model.

Supervised Machine Learning Algorithms

Supervised learning algorithms include the following:

1. **Penalized regression.** This reduces overfitting by imposing a penalty on—and reducing—the nonperforming features.
2. **Support vector machine.** This is a linear classification algorithm that separates the data into one of two possible classifiers based on a model-defined hyperplane.
3. **K-nearest neighbor.** This is used to classify an observation based on nearness to the observations in the training sample.
4. **Classification and regression tree.** This is used for classifying categorical target variables when there are significant nonlinear relationships among variables.
5. **Ensemble learning.** This combines predictions from multiple models, resulting in a lower average error rate.
6. **Random forest.** This is a variant of the classification tree whereby a large number of classification trees are trained using data bagged from the same data set.

Unsupervised Machine Learning Algorithms

Unsupervised learning algorithms include the following:

1. **Principal components analysis.** This summarizes the information in a large number of correlated factors into a much smaller set of uncorrelated factors called eigenvectors.
2. **K-means clustering.** This partitions observations into k non-overlapping clusters; a centroid is associated with each cluster.
3. **Hierarchical clustering.** This builds a hierarchy of clusters without any predefined number of clusters.

Neural Networks, Deep Learning Nets, and Reinforcement Learning

Neural networks comprise an input layer, hidden layers (which process the input), and an output layer. The nodes in the hidden layer are called neurons, which comprise a summation operator (that calculates a weighted average) and an activation function (a nonlinear function).

Deep learning nets are neural networks with many hidden layers (more than 20) useful for pattern, speech, and image recognition.

Reinforcement learning agents seek to learn from their own errors maximizing a defined reward.

BIG DATA PROJECTS

Cross-Reference to CFA Institute Assigned Reading #4

Steps in a Data Analysis Project

The steps involved in a data analysis project include the following: conceptualization of the modeling task, data collection, data preparation and wrangling, data exploration, and model training.

Preparing and Wrangling Data

Data cleansing deals with missing, invalid, inaccurate, and non-uniform values, as well as with duplicate observations. **Data wrangling** or preprocessing includes data transformation and scaling. Data transformation types include extraction, aggregation, filtration, selection, and conversion of data. **Scaling** is the conversion of data to a common unit of measurement. Common scaling techniques include normalization and standardization. **Normalization** scales variables between the values of 0 and 1, while standardization centers the variables at a mean of 0 and a standard deviation of 1. Unlike normalization, standardization is not sensitive to outliers, but it assumes that the variable distribution is normal.

Data Exploration

Data exploration involves exploratory data analysis, feature selection, and feature engineering. Exploratory data analysis looks at summary statistics describing the data and any patterns or relationships that can be observed. Feature selection involves choosing only those features that meaningfully contribute to the model's predictive power. Feature engineering optimizes the selected features.

Model Training

Before model training, the model is conceptualized: machine learning engineers work with domain experts to identify data characteristics and relationships. Machine learning seeks to identify patterns in the training data such that the model is able to generalize to out-of-sample data. Model fitting errors can be caused by using a small

training sample or by using an inappropriate number of features. Too few features may underfit the data, while too many features can lead to the problem of overfitting.

Model training involves model selection, model evaluation, and tuning.

Preparing, Wrangling, and Exploring Text-Based Data for Financial Forecasting

Text processing involves removing HTML tags, punctuations, numbers, and white spaces. Text is then normalized by lowercasing of words, removal of stop words, and stemming/lemmatization. Text wrangling involves tokenization of text. **N-grams** is a technique that defines a token as a sequence of words and is applied when the sequence is important. A **bag-of-words (BOW)** procedure then collects all the tokens in a document. A **document term matrix** organizes text as structured data: documents are represented by words and tokens by columns. Cell values reflect the number of times a token appears in a document.

Extracting, Selecting, and Engineering Features From Textual Data

Summary statistics for textual data includes term frequency and co-occurrence. A word cloud is a visual representation of all the words in a BOW such that words with higher frequency have a larger font size. This allows the analyst to determine which words are contextually more important. Feature selection can use tools such as document frequency, a Chi-square test, and mutual information. Feature engineering for text data includes identification of numbers, usage of N-grams, **name entity recognition (NER)**, or **parts-of-speech (POS)** tokenization.

Evaluating the Fit of a Machine Learning Algorithm

Model performance can be evaluated by using error analysis. For a classification problem, a confusion matrix is prepared and evaluation metrics such as precision, recall, accuracy score, and F1 score are calculated:

precision (P) = true positives / (false positives + true positives)

recall (R) = true positives / (true positives + false negatives)

accuracy = (true positives + true negatives) / (all positives and negatives)

F1 score = (2 × P × R) / (P + R)

The **receiver operating characteristic (ROC)** plots a curve showing the tradeoff between false positives and true positives.

Root mean squared error (RMSE) is used when the target variable is continuous.

$$\text{RMSE} = \sqrt{\frac{\sum_{i=1}^{n}(\text{predicted}_i - \text{actual}_i)^2}{n}}$$

Model tuning involves balancing bias error versus variance error, and selecting the optimal combination of hyperparameters.

ECONOMICS

Topic Weight on Exam	5%–10%
SchweserNotes™ Reference	Book 1, Pages 115–187

Economics will most likely be tested by asking you to apply the investment tools you learn in this section to the analysis of equity, fixed income, and derivative securities. For example, the lessons learned from economic growth models can be applied to the estimation of long-term growth rates needed in the dividend discount models in the Equity Valuation portion of the curriculum. As you read through the Level II economics material, look for links to security valuation and think about how the concepts might be tested as part of a broader valuation item set.

CURRENCY EXCHANGE RATES: UNDERSTANDING EQUILIBRIUM VALUE

Cross-Reference to CFA Institute Assigned Reading #5

Currency Cross Rates

A *cross rate* is the rate of exchange between two currencies implied by their exchange rates with a common third currency.

Suppose we are given three currencies A, B, and C. We can have three pairs of currencies (i.e., A/B, A/C, and B/C).

Rules:

$$\left(\frac{A}{C}\right)_{bid} = \left(\frac{A}{B}\right)_{bid} \times \left(\frac{B}{C}\right)_{bid}$$

$$\left(\frac{A}{C}\right)_{offer} = \left(\frac{A}{B}\right)_{offer} \times \left(\frac{B}{C}\right)_{offer}$$

To calculate the profits from a *triangular arbitrage*, imagine that three currencies each represent a corner of a triangle. Begin with a first currency (usually given in the question—we call it the home currency) and go around the triangle by exchanging the home currency for the first foreign currency, then exchanging the first foreign currency for the second foreign currency, and then exchanging the second foreign currency back into the home currency. If we end up with more money than we started with, we've earned an arbitrage profit.

The bid-ask spread forces us to buy a currency at a higher rate going one way than we can sell it for going the other way.

Follow the "up-the-bid-and-multiply and down-the-ask-and-divide" rule.

EXAMPLE: Triangular arbitrage

The following quotes are available from your dealer.

Quotes:

USD/EUR 1.271 – 1.272

EUR/GBP 1.249 – 1.250

USD/GBP 1.600 – 1.601

Is an arbitrage profit possible? If so, **compute** the arbitrage profit in USD if you start with USD 1 million.

Answer:

The implied cross rates:

$$\left(\frac{USD}{GBP}\right)_{bid} = \left(\frac{USD}{EUR}\right)_{bid} \times \left(\frac{EUR}{GBP}\right)_{bid} = 1.271 \times 1.249 = 1.587$$

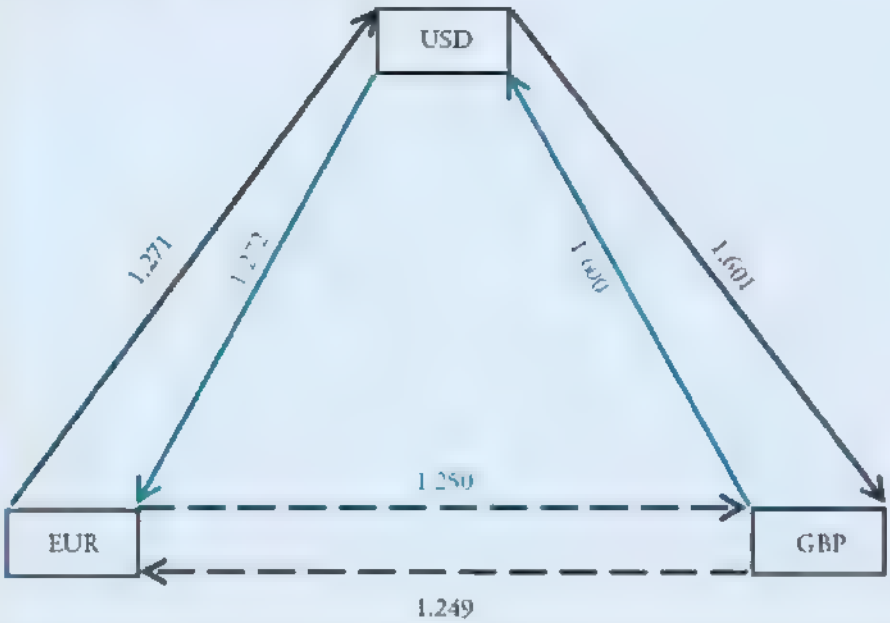
$$\left(\frac{USD}{GBP}\right)_{ask} = \left(\frac{USD}{EUR}\right)_{ask} \times \left(\frac{EUR}{GBP}\right)_{ask} = 1.272 \times 1.250 = 1.590$$

Since the dealer quote of USD/GBP = 1.600–1.601 falls outside of these cross rates, arbitrage profit may be possible (i.e., we have to check it).

There are two possible paths around the triangle (we are given the starting position in USD):

Path 1: USD → GBP → EUR → USD

Path 2: USD → EUR → GBP → USD



Since the dealer quotes imply that USD is undervalued relative to GBP (it costs more in USD to buy GBP using the dealer quote compared to the implied cross rates), if arbitrage exists, it will be via path 2. Make sure to use dealer quotes in the steps below instead of implied cross rates.

Step 1: Convert 1 million USD into EUR @ 1.272 = EUR 786,164

Step 2: Convert EUR 786,164 into GBP @ 1.250 = GBP 628,931

Step 3: Convert GBP 628,931 into USD @ 1.600 = USD 1,006,289

Arbitrage profit = USD 6,289

Note: In step 1, we are going from USD to EUR ("down" the USD/EUR quote), hence we divide USD 1,000,000 by the ask rate of 1.272. The same logic is used for steps 2 and 3. Note also that we did not have to compute the implied cross rate to solve this problem: we could've simply computed the end result using both paths to see if either would give us an arbitrage profit.

Mark-to-Market Value of a Forward Contract

The *mark-to-market value* of a forward contract reflects the profit that would be realized by closing out the position at current market prices, which is equivalent to offsetting the contract with an equal and opposite forward position:

$$V_t = \frac{(FP_t - FP)\ (\text{contract size})}{\left[1 + R\left(\frac{\text{days}}{360}\right)\right]}$$

where:

V_t = value of the forward contract at time t (to the party buying the base currency), denominated in the price currency

FP_t = forward price (to sell base currency) at time t in the market for a new contract maturing at time T ($t < T$)

days = number of days remaining to maturity of the forward contract ($T - t$)

R = the interest rate of the price currency

EXAMPLE: Mark-to-market value of a forward contract

Yew Mun Yip has entered into a 90-day forward contract long CAD 1 million against AUD at a forward rate of 1.05358 AUD/CAD. Thirty days after initiation, the following AUD/CAD quotes are available:

Maturity	FX Rate
Spot	1.0612/1.0614
30-day	+4.9/+5.2
60-day	+8.6/+9.0
90-day	+14.6/+16.8
180-day	+42.3/+48.3

The following information is available (at t = 30) for AUD interest rates:

30-day rate: 1.12%

60-day rate: 1.16%

90-day rate: 1.20%

What is the mark-to-market value in AUD of Yip's forward contract?

Answer:

Yip's contract calls for long CAD (i.e., converting AUD to CAD). To value the contract, we would look to unwind the position. To unwind the position, Yip can take an offsetting position in a new forward contract with the same maturity. Hence, Yip

would be selling CAD in exchange for AUD and, hence, going up the bid (i.e., use the bid price). Note that after 30 days, 60 more days remain in the original contract.

The forward bid price for a new contract expiring in T − t = 60 days is 1.0612 + 8.6 / 10,000 = 1.06206.

The interest rate to use for discounting the value is also the 60-day AUD interest rate of 1.16%:

$$V_t = \frac{(FP_t - FP)\ (\text{contract size})}{\left[1 + R\left(\frac{\text{days}}{360}\right)\right]}$$

$$= \frac{(1.06206 - 1.05358)\ (1{,}000{,}000)}{\left[1 + 0.0116\left(\frac{60}{360}\right)\right]} = 8{,}463.64$$

Thirty days into the forward contract, Yip's position has gained (positive value) AUD 8,463.64. This is because Yip's position is long CAD, which has appreciated relative to AUD since inception of the contract. Yip can close out the contract on that day and receive AUD 8,463.64.

Note: Be sure to use the AUD (price currency) interest rate.

International Parity Conditions

Note: Exchange rates (where applicable) below follow the convention of A/B.

Covered interest arbitrage:

Covered interest rate parity holds when any forward premium or discount exactly offsets differences in interest rates so an investor would earn the same return investing in either currency. Covered in this context means it holds by arbitrage.

$$F = \frac{\left[1 + R_A\left(\frac{\text{days}}{360}\right)\right]}{\left[1 + R_B\left(\frac{\text{days}}{360}\right)\right]} S_0$$

Uncovered interest rate parity:

Uncovered interest rate parity relates expected future spot exchange rates (instead of forward exchange rates) to interest rate differentials. Since the expected spot price is not market traded, uncovered interest rate parity does not hold by arbitrage.

$$E(\%\Delta S)_{(A/B)} = R_A - R_B$$

Comparing covered and uncovered interest parity, we see that covered interest rate parity gives us the no-arbitrage forward exchange rate, while uncovered interest rate parity concerns changes in the *expected* future spot exchange rate (which is not market traded).

International Fisher relation:

$$R_A - R_B = E(\text{inflation}_A) - E(\text{inflation}_B)$$

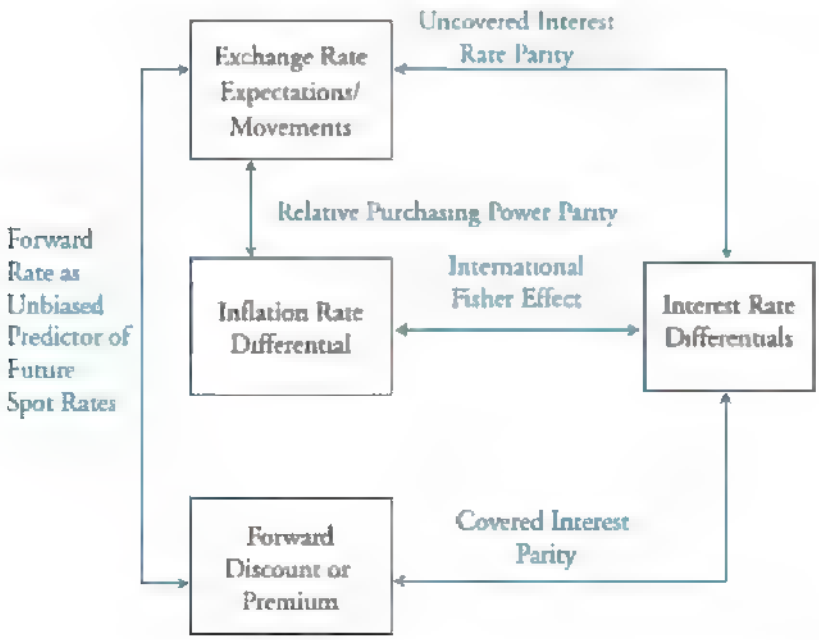
This relation tells us that the difference between two countries' nominal interest rates should be approximately equal to the difference between their expected inflation rates.

Relative purchasing power parity (relative PPP) states that changes in exchange rates should exactly offset the price effects of any inflation differential between two countries.

Relative PPP:

$$\%\Delta S_{(A/B)} = \text{inflation}_{(A)} - \text{inflation}_{(B)}$$

Figure 1: The International Parity Relationships Combined



Several observations can be made from the relationships among the various parity relationships:

- Covered interest parity holds by arbitrage. If forward rates are unbiased predictors of future spot rates (i.e., forward rate parity holds), uncovered interest rate parity also holds (and vice versa).
- Interest rate differentials should mirror inflation differentials. This holds true if the international Fisher relation holds. If that is true, we can also use inflation differentials to forecast future exchange rates which is the premise of the ex-ante version of PPP.
- If the ex-ante version of relative PPP as well as the international Fisher relation both hold, uncovered interest rate parity will also hold.

The FX Carry Trade

The *FX carry trade* seeks to profit from the failure of uncovered interest rate parity to hold in the short run. In an FX carry trade, the investor invests in a high-yield currency (i.e., the investing currency) while borrowing in a low-yield currency (i.e., the funding currency). If the higher yield currency does not depreciate by the interest rate differential, the investor makes a profit.

profit on carry trade = interest differential − change in the spot rate of investment currency

The carry trade is inherently a leveraged trade that is exposed to crash risk, as the underlying return distributions of carry trades are non-normal (negative skewness and excess kurtosis).

Balance of Payments (BOP) Analysis

BOP influence on exchange rates can be analyzed based on current account influence and capital account influence.

Current account influences include:

- *Flow mechanism.* A current account deficit puts downward pressure on the exchange value of a country's currency. The decrease in the value of the currency *may* restore the current account deficit to a balance depending on the initial deficit, the influence of exchange rates on export and import prices, and the price elasticity of demand of traded goods.
- *Portfolio composition mechanism.* Investor countries with capital account deficits (and current account surpluses) may find their portfolios dominated by investments in countries persistently running capital account surpluses (and current account deficits). If/when the investor countries rebalance their portfolios, the investee countries' currencies may depreciate.
- *Debt sustainability mechanism.* A country running a current account deficit may be running a capital account surplus by borrowing from abroad. When the level of debt gets too high relative to GDP, investors may question the sustainability of this level of debt, leading to a rapid depreciation of the borrower's currency.

Capital account inflows (outflows) are one of the major causes of appreciation (depreciation) of a country's currency.

Approaches to Exchange Rate Determination

1. **Mundell-Fleming model**

   Figure 2 shows the impact of monetary and fiscal policies in the short run under the *Mundell-Fleming model.*

Figure 2: Monetary and Fiscal Policy and Exchange Rates

Monetary Policy/Fiscal Policy	Capital Mobility	
	High	Low
Expansionary/expansionary	Uncertain	Depreciation
Expansionary/restrictive	Depreciation	Uncertain
Restrictive/expansionary	Appreciation	Uncertain
Restrictive/restrictive	Uncertain	Appreciation

2. **Monetary models**

The monetary models focus on the influence of monetary policy on inflation and, hence, exchange rates.

A) **Pure monetary model.** PPP holds at any point in time and, therefore, an expansionary monetary policy results in an increase in inflation and a depreciation of the home currency.

B) **Dornbusch overshooting model.** A restrictive (expansionary) monetary policy leads to an excessive appreciation (depreciation) of the domestic currency in the short term and then a slow depreciation (appreciation) toward the long-term PPP value.

3. **Portfolio balance model (asset market approach)**

Focuses on the long-term implications of sustained fiscal policy (deficit or surplus) on currency values. When the government runs a fiscal deficit, it borrows money from investors. Under the portfolio balance approach, sustained fiscal deficits will lead to eventual depreciation of the home currency.

Capital Controls and Central Bank Intervention

Capital controls and central bank intervention aim to reduce excessive capital inflows which could lead to speculative bubbles. The success of central bank intervention depends on the size of official FX reserves at the disposal of the central bank relative to the average trading volume in the country's currency. For developed markets, central bank resources on a relative basis are too insignificant to be effective at managing exchange rates. However, some emerging market countries with large FX reserves relative to trading volume have been somewhat effective. Persistent and large capital flows are harder for central banks to manage using capital controls.

Warning Signs of an Impending Currency Crisis

- Terms of trade deteriorate.
- Official foreign exchange reserves dramatically decline.
- Currency value is substantially higher than the mean-reverting level.
- Inflation increases.
- Liberalized capital markets allow free flow of capital.
- Money supply relative to bank reserves increases.
- Banking crises occur.
- Fixed or partially fixed exchange rates exist.

ECONOMIC GROWTH

Cross-Reference to CFA Institute Assigned Reading #6

Preconditions for Economic Growth

The following factors are positively related to growth rate of an economy:

- Level of savings and investment.
- Developed financial markets and intermediaries.

- Political stability, rule of law, and property rights.
- Investment in human capital (e.g., education, health care).
- Favorable tax and regulatory systems.
- Free trade and unrestricted capital flows.

Sustainable Growth Rate of an Economy

In the long run, the rate of aggregate stock market appreciation is limited to the sustainable growth rate of the economy.

Potential GDP

Potential GDP represents the maximum output of an economy without putting upward pressure on prices. Higher potential GDP growth increases the potential for stock returns and also increases the credit quality of fixed income investments.

In the short term, the difference between potential GDP and actual GDP may be useful for predicting fiscal/monetary policy. If actual GDP is less than potential GDP, inflation is unlikely and the government may follow an expansionary policy.

Capital Deepening Investment and Technological Process

Cobb-Douglas Production Function

$$Y = TK^{\alpha}L^{(1-\alpha)}$$

where:

Y = the level of aggregate output in the economy

α and $(1-\alpha)$ = the share of output allocated to capital (K) and labor (L), respectively

T = a scale factor that represents the technological progress of the economy, often referred to as *total factor productivity* (TFP)

The *Cobb-Douglas function* essentially states that output (GDP) is a function of labor and capital inputs, and their productivity. It exhibits constant returns to scale; increasing all inputs by a fixed percentage leads to the same percentage increase in output.

Dividing both sides by L in the Cobb-Douglas production function, we can obtain the output per worker (labor productivity).

$$\text{output per worker} = Y/L = T(K/L)^{\alpha}$$

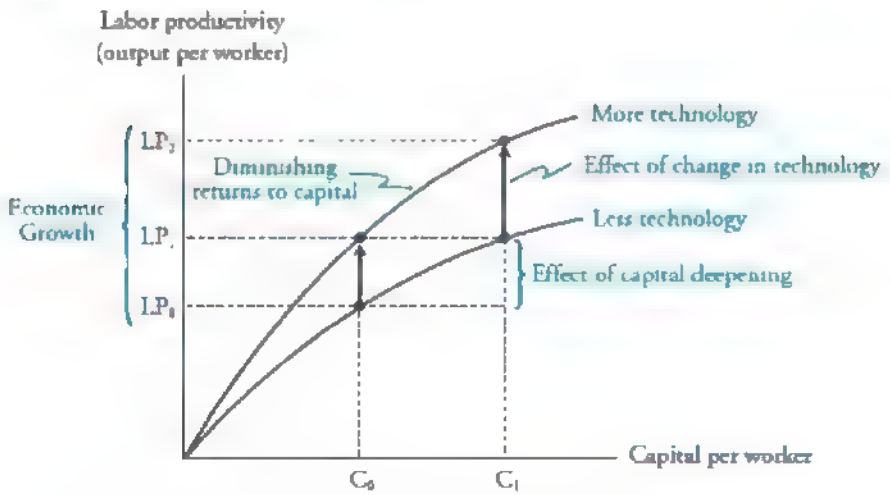
Capital deepening is an increase in the capital-to-labor ratio. Due to diminishing marginal productivity of capital, increases in the capital per worker can lead to only limited increases in labor productivity if the capital-to-labor ratio is already high.

Technological progress impacts the productivity of all inputs—labor and capital. The long-term growth rate can be increased by technological progress (also called *total factor productivity*) since output and labor efficiency are increased at all levels of capital-to-labor ratios.

In steady state (i.e., equilibrium), the marginal product of capital (MPK = αY/K) and marginal cost of capital (i.e., the *rental price of capital*, r) are equal, hence αY/K = r.

The productivity curves in Figure 3 show the effect of increasing capital per worker on output per worker. Capital deepening is a movement *along* the productivity curve. The curvature of the relationship derives from the diminishing marginal productivity of capital. Technological progress *shifts* the productivity curve upward and will lead to increased productivity at all levels of capital per worker.

Figure 3: Productivity Curves



Growth Accounting Relations

growth rate in potential GDP = long-term growth rate of technology
+ α (long term growth rate in capital)
+ (1 − α) (long-term growth rate in labor)

or

growth rate in potential GDP = long-term growth rate of labor force
+ long-term growth rate in labor productivity

EXAMPLE: Estimating potential GDP growth rate

Azikland is an emerging market economy where labor accounts for 60% of total factor cost. The long-term trend of labor growth of 1.5% is expected to continue. Capital investment has been growing at 3%. The country has benefited greatly from borrowing the technology of more developed countries; total factor productivity is expected to increase by 2% annually. **Compute** the potential GDP growth rate for Azikland.

Answer:

Using the growth accounting equation,

$$\%\Delta Y = 2\% + (0.4)(3\%) + (0.6)(1.5\%) = 4.1\%$$

Theories of Economic Growth

Classical growth theory contends that growth in real GDP per capita is temporary—when the GDP per capita rises above the subsistence level, a population explosion occurs and GDP per capita is driven back to the subsistence level.

Neoclassical growth theory contends that the sustainable growth rate of an economy is a function of population growth, labor's share of income, and the rate of technological advancement. Growth gains from other means, such as increased savings, are only temporary.

Under the neoclassical growth theory, *sustainable growth of output per capita* (g^*) is equal to growth rate in technology (θ) divided by labor's share of GDP ($1 - \alpha$):

$$g^* = \frac{\theta}{(1-\alpha)}$$

In the steady state, the growth rate of output per worker (g^*) is same as the growth rate of capital per worker.

The sustainable growth rate of output (G^*) is equal to the sustainable growth rate of output per capita plus growth of labor (ΔL).

$$G^* = g^* + \Delta L$$

Neoclassical theory yields several implications about sustainable growth and inputs:

- Capital deepening affects the level of output but not the growth rate in the long run. Capital deepening may lead to temporary growth but growth will revert back to the sustainable level if there is no change in technology.
- The growth rate in an economy will move toward its steady state rate regardless of initial capital to labor ratio or level of technology.
- In the long term, the growth rate in productivity (i.e., output per capita) is a function of only the growth rate of technology (θ) and the share of labor to total output ($1 - \alpha$).
- An increase in savings will only temporarily raise the rate of growth in an economy. However, countries with a higher savings rate will enjoy a higher capital to labor ratio and higher productivity.

Endogenous growth theory acknowledges the impact of technological progress within the model. Under endogenous growth theory, investment in capital can have constant returns, unlike neoclassical theory which assumes diminishing returns to capital. This assumption allows for a permanent increase in growth rate attributable to an increase in savings rate. Research and development expenditures are often cited as examples of capital investment that increase technological progress.

Convergence Hypotheses

The **absolute convergence** hypothesis states that less-developed countries will converge to the standard of living of developed countries.

The **conditional convergence** hypothesis assumes that convergence in living standards will occur for countries with the same savings rate, population growth, and production functions.

The **club convergence** hypothesis contends that some less developed countries may converge to developed standards if they are in the "club" of countries. A club comprises countries with similar institutional structures, such as property rights and political stability. Countries outside of the club (without the appropriate institutional structures) will not converge.

ECONOMICS OF REGULATION

Cross-Reference to CFA Institute Assigned Reading #7

Economic Rationale for Regulatory Intervention

Regulations are needed in the presence of **informational frictions**, **externalities**, weak competition, or to achieve specific social objectives.

Purposes of Regulating Commerce and Financial Markets

Examples of regulations covering commerce include company law, tax law, contract law, competition law, banking law, bankruptcy law, and dispute resolution systems.

Governments may facilitate or hinder commerce.

Financial market regulations seek to protect investors and ensure the stability of financial systems. Securities market regulations include disclosure requirements, regulations to mitigate agency conflicts, and regulations to protect small investors.

Prudential supervision is the regulation and monitoring of financial institutions to reduce system-wide risks and protect investors.

Anticompetitive Behaviors Targeted by Antitrust Laws Globally

Regulators often block a merger that would lead to an excessive concentration of market share. Additionally, anticompetitive behavior such as discriminatory pricing, bundling, and exclusive dealing is often prohibited.

Classifications of Regulations and Regulators

Regulations can be classified as **statutes**, **administrative regulations**, or **judicial law**.

Regulators can be government agencies or **independent regulators. Self-regulatory bodies (SRBs)** do not have government recognition, and they represent as well as regulate their members. **Self-regulating organizations (SROs)** are SRBs that are given government recognition and authority.

Outside bodies are not regulators themselves, but their product may be referenced by regulators.

Uses of Self-Regulation in Financial Markets

SROs, when properly supervised by regulatory agencies, have been effective in carrying out the objectives of regulations. The use of SROs is more prevalent in common-law countries than in civil-law countries.

Regulatory Interdependencies and Their Effects

The **regulatory capture** theory is based upon the assumption that a regulatory body will be influenced or even controlled by the industry that is being regulated.

Regulatory differences between jurisdictions can lead to regulatory competition wherein regulators compete to provide the most business-friendly regulatory environment. Firms may use **regulatory arbitrage** to exploit the difference between the substance and interpretation of a regulation.

Tools of Regulatory Intervention in Markets

Regulatory tools include **price mechanisms**, **restrictions on** or **requirement of certain activities**, and **provision of public goods** or **financing of private projects**.

Benefits and Costs of Regulation

Regulatory burden refers to the cost of compliance for the regulated entity. Regulatory burden minus the private benefits of regulation is known as the **net regulatory burden.** Indirect costs of regulations need to be included in the cost benefit analysis of regulations but are difficult to measure ex ante. **Sunset clauses** require a cost benefit analysis to be revisited before the regulation is renewed.

Evaluating the Effects of Regulation on an Industry

Regulations can have material impacts on industries and companies. Certain industries have more exposure to certain types of regulations. Analysts should review the impact of current and proposed regulations, as regulations can have a large impact on valuations for a particular company or industry.

FINANCIAL STATEMENT ANALYSIS

Topic Weight on Exam	10%–15%
SchweserNotes™ Reference	Book 2, Pages 1–219

INTERCORPORATE INVESTMENTS

Cross-Reference to CFA Institute Assigned Reading #8

Accounting for Intercorporate Investments

Percentage of ownership is typically used as a practical guide to determine influence or control for financial reporting purposes. Figure 1 contains the guidelines used to determine which reporting method is required for intercorporate investments. The conceptual distinction for determining reporting methods centers on the degree to which the investee (affiliate) is an integral part of the investor (parent).

Figure 1: Accounting Standards for Intercorporate Investments

Ownership	Degree of Influence/ Control	IFRS/U.S. GAAP Method
Less than 20%	No significant influence	Depends on security classification
20% to 50%	Significant influence	Equity method
Each party owns 50%	Shared control/joint venture	Equity method*
More than 50%	Control	Acquisition

* In rare cases, proportionate consolidation is allowed under U.S. GAAP and under IFRS.

Classifications of Financial Securities (IFRS 9)

Amortized Cost (for Debt Securities Only)

Debt securities are accounted for using the amortized cost method if they meet both of the following criteria: (1) a business model test (the securities are being held to collect contractual cash flows) and (2) a cash flow characteristic test (contractual cash flows must be either principal or interest on principal).

Fair Value Through Profit or Loss (for Debt and Equity Securities)

Debt securities may be classified as *fair value through profit or loss* if either (1) they are held for trading or (2) accounting for those securities at amortized cost would result in an *accounting mismatch*. Equity securities that are held for trading must be classified as fair value through profit or loss. Other equity securities may be classified as either fair value through profit or loss, or fair value through OCI. Once classified, the choice is irrevocable.

Fair Value Through Other Comprehensive Income (for Debt and Equity Securities)

The accounting treatment under fair value through OCI is the same as under the previously used available-for-sale classification.

Reclassification Under IFRS 9

Reclassification of equity securities under the new standards is not permitted as the initial designation (FVPL or FVOCI) is irrevocable. Reclassification of debt securities is permitted only if the business model has changed. Unrecognized gains/losses on debt securities carried at amortized cost and reclassified as FVPL are recognized in the income statement. Debt securities that are reclassified out of FVPL as measured at amortized cost are transferred at fair value on the transfer date, and that fair value becomes the carrying amount.

Equity Method

Under the *equity method*, the investment is listed at cost on the balance sheet. Dividends that are paid by the investee increase cash and decrease the investment account on the asset side of the balance sheet. In addition, the investor's pro rata share of the investee's net income increases the asset account and is listed as income on the investor's income statement. In other words, the investment amount grows by investor's share of change in investee's retained earnings.

There are two adjustments that need special attention:

1. Adjustment for additional depreciation due to the difference between the fair value and book value of the investee's fixed assets. This difference is measured initially when the investment is made, and then the investor's pro rata share is depreciated using the same method as the investee uses.
2. Removal of a pro rata share of unconfirmed profits (upstream or downstream).

Acquisition Method

Under the acquisition method, the balance sheets of the two entities are *consolidated* as follows: add together all asset and liability accounts net of intercorporate transfers; do not adjust the equity accounts of the parent; and list the minority interest as a separate component of stockholders' equity. Minority interest is equal to the proportion of the subsidiary that the parent does not own times the net equity of the subsidiary.

On the consolidated income statement, add the revenues and expenses of the parent and the subsidiary together as of the consolidation date. Subtract the minority shareholders' share of the subsidiary's net income from this amount. The minority interest amount on the income statement equals the proportion of the subsidiary the parent does not own multiplied by the net income of the subsidiary.

Effect of Choice of Method on Reported Financial Performance

There are four important effects on certain balance sheet and income statement items that result from the choice of accounting method (in most situations):

1. Both (equity and acquisition) methods report the same net income.
2. Compared to the equity method, acquisition method equity will be higher by the amount of minority interest.
3. Assets and liabilities are higher under the acquisition method compared to the equity method.
4. Sales and expenses are higher under the acquisition method compared to the equity method.

Assuming net income is positive, these effects generally result in the equity method reporting more favorable results compared to the acquisition method, as shown in Figure 2.

Figure 2: Differences in Reported Financial Results from Choice of Method

	Equity Method	Acquisition	Explanation
Net profit margin*	Higher	Lower	Sales are lower under equity method, while net income is the same.
ROE*	Higher	Lower	Equity is higher under Acquisition method (due to minority interest), while net income is the same.
ROA*	Higher	Lower	Assets are lower under equity method, while net income is the same.

* Assuming net income is positive

Special Purpose Entities and Variable Interest Entities

A special purpose entity (SPE), also known as a special purchase vehicle or off-balance sheet entity, is a legal structure created to isolate certain assets and obligations of the sponsor. SPEs are usually formed to serve a specific purpose, so they are limited in scope. The typical motivation is to obtain low-cost financing. An SPE can take the form of a corporation, partnership, joint venture, or trust, although the entity does not necessarily have separate management or even employees.

U.S. GAAP uses the name variable interest entity (VIE) to identify an SPE that meets certain conditions. If an entity is considered a VIE, it must be consolidated by the primary beneficiary.

Following are some examples of common variable interests:

- *At-risk equity investment.* The investor receives the residual benefits but also absorbs the potential losses.
- *Debt guarantee.* In the event of default, the guarantor will experience a loss.
- *Subordinated debt.* Since senior debt is repaid before subordinated debt, the subordinated debtholders absorb the loss in the event the senior debtholders cannot be repaid.

- *Lease residual guarantee.* The lessee guarantees the fair value of the asset at the end of the lease. If the fair value is less than the guaranteed amount, the lessee experiences a loss.
- *Participation rights.* The holder receives a predetermined share of the profit.
- *Asset purchase option.* The holder benefits from an increase in the fair value of the asset.

EMPLOYEE COMPENSATION: POST-EMPLOYMENT AND SHARE-BASED

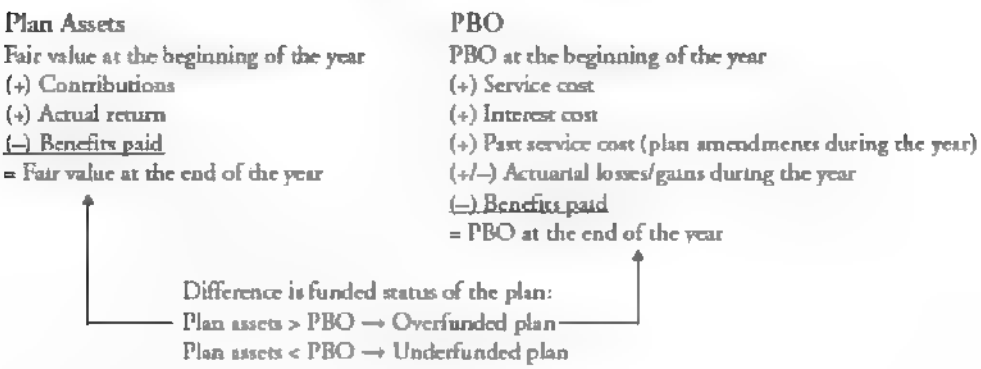
Cross-Reference to CFA Institute Assigned Reading #9

The Pension Obligation for a Defined-Benefit Plan

The **projected benefit obligation (PBO)** is the actuarial present value (at the assumed discount rate) of all future pension benefits earned to date, based on expected future salary increases. It measures the value of the obligation assuming the firm is a going concern.

Reconciliation of Beginning and Ending PBO

Figure 3: Funded Status of a Pension Plan



Balance Sheet Effects

The funded status reflects the economic standing of a pension plan:

funded status = fair value of plan assets − PBO

The balance sheet presentation under both U.S. GAAP and IFRS is as follows:

balance sheet asset (liability) = funded status

Pension Expense Components

Figure 4: Difference Between Recognition of Components of Pension Costs Under U.S. GAAP and IFRS

Component	U.S. GAAP	IFRS
Current service cost	Income statement	Income statement
Past service cost	OCI, amortized over service life	Income statement
Interest cost	Income statement	Income statement
Expected return	Income statement	Income statement*
Actuarial gains/losses	Amortized portion in income statement. Unamortized in OCI.	All in OCI—not amortized (called 'Remeasurements')

* Under IFRS, the expected rate of return on plan assets equals the discount rate and net interest expense/income is reported

Additional explanation for these components follows:

- *Service cost.* Increase in the PBO reflecting the pension benefits earned during the year.
- *Interest cost.* Increase in PBO resulting from interest owed on the current benefit obligation.
- *Expected return on plan assets.* Under U.S. GAAP, assumed long run rate of return on plan assets used to smooth the volatility that would be caused by using actual returns. Under IFRS, expected rate of return on plan assets is implicitly equal to the discount rate used for computing PBO.
- *Amortization of unrecognized prior service cost.* Amortized costs for changes in the PBO that result from amendments to the plan (under U.S. GAAP only). Under IFRS, prior service costs are expensed immediately and not amortized.
- *Amortization and deferral of gains or losses.* Amortization of gains and losses caused by (1) changes in actuarial assumptions and (2) differences between actual and expected return on plan assets. Under U.S. GAAP, actuarial gains and losses are recognized in OCI and amortized using the corridor method. Under IFRS, actuarial gains and losses (called remeasurements) are recognized in OCI and not amortized.

Interest Cost Computation

U.S. GAAP: Interest cost = discount rate × (beg. PBO – past service costs)

IFRS: Net interest (cost)/income = discount rate × (beg. funded status – past service costs)

Total Periodic Pension Cost

Analysts often calculate **total periodic pension cost (TPPC)** by eliminating the smoothing amounts and including the *actual* return on assets. The result is a more volatile measure of pension expense. TPPC includes pension expense recognized in the income statement and pension cost that bypasses income statement (i.e., recognized in OCI). While TPPC calculated under U.S. GAAP is the same as that calculated under IFRS, the allocation between income statement and OCI differs.

TPPC can be calculated by computing increase in PBO for the period (adjusted for benefits payments) and then subtracting the actual return on assets.

TPPC = ending PBO − beginning PBO + benefits paid − actual return on plan assets

Alternatively, TPPC is equal to the contributions minus the change in funded status during the year.

TPPC = contributions − (ending funded status − beginning funded status)

Fundamental Pension Assumptions

The company must make and disclose three actuarial assumptions in the pension footnotes:

1. The **discount rate** is the interest rate used to compute the present value of the pension obligations. This is the interest rate at which the company could settle its pension obligation. Notice that this is not the risk-free rate.
2. The **rate of compensation increase** is the average annual rate at which employee compensation is expected to increase over time.
3. The **expected return on plan assets** (U.S. GAAP only) is the long-term assumed rate of return on the investments in the plan. Using an expected long-run return assumption rather than actual returns serves to smooth the net pension expense calculation.

Any changes in assumptions that might cause only a small change in the total pension obligation itself can still have a large impact on the net pension asset or liability. The same is true with pension expense; because it is a net amount (service and interest cost net of expected return on plan assets), relatively minor changes in the assumptions can have a major impact on reported pension expense.

Assumptions of high discount rates, low compensation growth rates, and high expected rates of return on plan assets will decrease pension expense, increase earnings, and reduce the pension liability. The more aggressive these assumptions are, the lower the earnings quality of the firm.

The use of a lower rate of compensation growth will improve reported results because it will result in the following:

- Lower estimated future pension payments and, hence, a lower PBO.
- Lower service cost and a lower interest cost; thus, pension expense will decrease.

Figure 5: Effect of Changes in Assumptions

Effect on…	Increase Discount Rate	Decrease Rate of Compensation Growth	Increase Expected Rate of Return
PBO	Decrease	Decrease	No effect
Total periodic pension cost	Decrease*	Decrease	No effect
Periodic pension cost in P&L	Decrease*	Decrease	Decrease**

* For mature plans, a higher discount rate might increase interest costs. In rare cases, interest cost will increase by enough to offset the decrease in the current service cost, and periodic pension cost will increase

** Under U.S. GAAP only. Not applicable under IFRS.

Non-Pension Postretirement Benefits

Accounting for *non-pension* postretirement benefits is very similar to accounting for pension benefits, with the following differences:

- The accumulated postretirement benefit obligation (APBO) is the actuarial present value of the expected postretirement benefits. It is estimated using a discount rate applied specifically to those benefits.
- Many postretirement benefit plans are unfunded, which means there are no plan assets, employer contributions equal benefits paid, and the funded status (liability) equals the APBO.

Share-Based Compensation

Firms must report compensation expense related to stock option plans on the income statement based on the option's value at issuance. This can significantly decrease reported earnings.

Firms are required to recognize compensation expense based on the fair value of share-based awards as of the grant date. The fair value is estimated using an option pricing model. This expense is amortized over the period required for vesting of the options (i.e., the service period). This expensing of stock options results in lower net income and hence lower retained earnings. The offsetting entry is an increase in paid-in-capital, leaving (total) stockholders' equity unchanged.

MULTINATIONAL OPERATIONS

Cross-Reference to CFA Institute Assigned Reading #10

Transaction Exposure

Transactions denominated in foreign currencies are measured in the presentation (reporting) currency at the spot rate on the transaction date. If the exchange rate changes, a gain or loss is recognized on the settlement date. If the balance sheet date occurs before the transaction is settled, the gain or loss is based on the exchange rate on the balance sheet date. After the transaction has settled, additional gain or loss is recognized if the exchange rate changes after the balance sheet date.

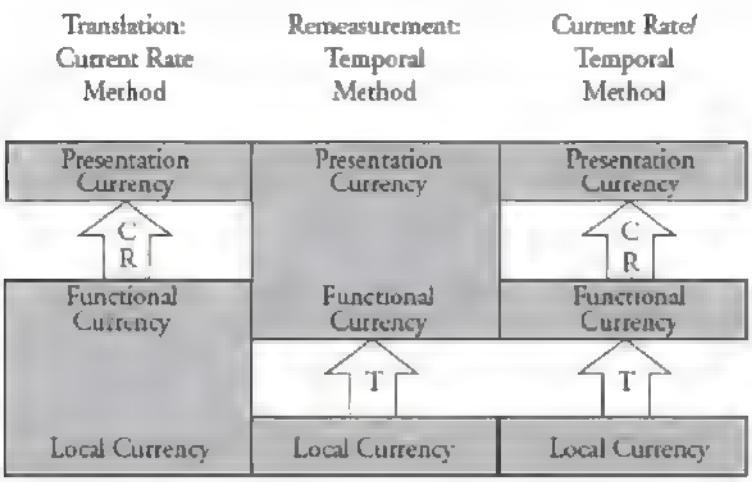
Translation of Foreign Currency Denominated Financial Statements of Subsidiaries

From a financial statement analysis view, there are two tasks that must be understood in multinational operations. First, you must know and be able to apply two different methods of consolidating foreign subsidiaries' operating results into the parent's financial statements. Second, you must understand how these two different accounting procedures affect the parent's financial statements and ratios.

The two methods of consolidation are the *temporal method* (sometimes also referred to as *remeasurement*) and the *current rate method* (a.k.a. *translation*). The appropriate method depends on the subsidiary's functional currency (i.e., the currency in which the subsidiary generates and expends most of its cash). The rules that govern the determination of the functional currency under SFAS 52 are as follows:

- The results of operations, financial position, and cash flows of all foreign operations must be measured in the designated functional currency.
- Self-contained, independent subsidiaries whose operations are primarily located in the local market will use the local currency as the functional currency.
- Subsidiaries whose operations are well integrated with the parent will use the parent's currency as the functional currency.
- If the functional currency is the local currency, use the current rate method.
- If the functional currency is the parent's currency or some other currency, use the temporal method.

Figure 6: Three Methods for Remeasurement/Translation of Local Currencies



When consolidating the results of foreign subsidiaries, it is important to decide which exchange rate should be used for each account. There are essentially three choices: (1) the current exchange rate, (2) the average exchange rate over the reporting period, and (3) the historical exchange rate (which is the rate that existed when a particular transaction occurred). Which you use depends on which method is appropriate. Study and memorize the information contained in Figure 7.

Figure 7: Exchange Rate Usage Under the Temporal and Current Rate Methods

Account	Rate Used to Translate Account Using the...	
	Temporal Method	Current Rate Method
Monetary assets/liabilities	Current rate	Current rate
Nonmonetary assets/ liabilities	Historical rate	Current rate
Common stock	Historical rate	Historical rate
Equity (taken as a whole)	Mixed*	Current rate**
Revenues and SG&A	Average rate	Average rate
Cost of goods sold	Historical rate	Average rate
Depreciation	Historical rate	Average rate
Net income	Mixed*	Average rate
Exposure	Net monetary assets	Shareholders' equity
Exchange rate gain or loss	Income statement	Equity

* Net income is a "mixed rate" under the temporal method because (1) the FX translation gain or loss is shown on the income statement, (2) revenues and SG&A are remeasured at average, while (3) COGS and depreciation are remeasured at historical. Equity is "mixed" because the change in retained earnings (which includes net income) is posted to the equity accounts.

** Under the current rate method, total assets and liabilities are translated at the current rate. The total equity (equity taken as a whole) would then have to be translated at the current rate for the balance sheet to balance.

Calculating the Translation Gain or Loss

Translation gains or losses result from gains or losses related to balance sheet accounts that are translated at the current rate (i.e., they are exposed to changes in exchange rates).

Under the current rate method, all assets and liabilities are translated at the current rate, so the net exposure is assets minus liabilities, or total shareholders' equity:

exposure under the current rate method = shareholders' equity

Under the temporal method, only cash, accounts receivable, accounts payable, current debt, and long-term debt are translated at the current rate (remember that inventory and fixed assets are translated at the historical rate):

exposure under the temporal method = (cash + accounts receivable) – (accounts payable + current debt + long-term debt) = net monetary assets

Under the current rate method, the translation gains/losses are accumulated on the balance sheet in the equity section as part of comprehensive income in an account called the **cumulative translation adjustment (CTA)**.

Under the temporal method, no CTA is reported in shareholders' equity. Instead, the remeasurement gain or loss is recognized in the income statement.

Comparing Subsidiary Results to Translated Results (Current Rate Method)

On the exam, remember these key points regarding the original versus the translated financial statements and ratios.

- Pure balance sheet and pure income statement ratios will be the same.
- If the LC is depreciating, translated mixed ratios (with an income statement item in the numerator and an end-of-period balance sheet item in the denominator) will be larger than the original ratio.
- If the LC is appreciating, translated mixed ratios (with an income statement item in the numerator and an end-of-period balance sheet item in the denominator) will be smaller than the original ratio.

Comparing Results Using the Temporal and Current Rate Methods

The effects on a selected set of ratios of the choice between the current rate and temporal methods are shown in Figure 8.

Figure 8: Effect of Translation Methods on Selected Financial Ratios

	Appreciating Local Currency		Depreciating Local Currency	
	Temporal	**Current Rate**	**Temporal**	**Current Rate**
*Liquidity Ratios**				
Current ratio (assuming subsidiary has inventory)	Lower	Higher	Higher	Lower
Quick ratio	Same	Same	Same	Same
A/R turnover	Same	Same	Same	Same
Inventory turnover	Uncertain	Uncertain	Uncertain	Uncertain
*Operating Efficiency Ratios**				
Fixed asset turnover	Higher	Lower	Lower	Higher
Total asset turnover	Higher	Lower	Lower	Higher
*Profitability Ratios**				
Gross profit margin	Higher	Lower	Lower	Higher
Net profit margin	Uncertain	Uncertain	Uncertain	Uncertain
ROE	Uncertain	Uncertain	Uncertain	Uncertain
ROA	Uncertain	Uncertain	Uncertain	Uncertain
*Financial Leverage Ratios**				
Interest coverage	Higher	Lower	Lower	Higher
LTD to total capital	Higher	Lower	Lower	Higher

* Ratios are calculated using end-of-period balance sheet numbers

Effective Tax Rate

Earnings of multinational companies are subject to multiple tax jurisdictions, so the **effective tax rate** often differs from the **statutory tax rate**. Expected changes in the

mix of profits from different countries can be used by the analyst to forecast future tax expenses for the company.

Earnings Sustainability

Revenues of multinational companies may be denominated in different currencies but are translated into the reporting currency for the purpose of preparing financial statements. Revenue growth can occur due to price and volume changes, or due to changes in exchange rates. Analysts separate the two because the growth in revenues due to changes in price and/or volume is considered more sustainable.

ANALYSIS OF FINANCIAL INSTITUTIONS

Cross-Reference to CFA Institute Assigned Reading #11

One important way that financial institutions differ from manufacturers, for example, is that financial institutions have much higher exposure to various financial risks, including market risk, interest rate risk, credit risk, and liquidity risk. These risks stem from the fact that bank assets are made up of financial assets, which have values that fluctuate with market values.

Regulation of Financial Institutions

Systemic risk means risks that have the potential to spread and negatively impact the whole economy. The systemic importance of financial institutions has resulted in heavy regulation of these firms' activities.

Minimum liquidity requirements, minimum capital requirements, and stable funding requirements are all specified by the Basel Committee's International Regulatory Framework for Banks.

The CAMELS Approach to Analyzing a Bank

CAMELS is perhaps the best known method of systematically scrutinizing a bank's level of systematic risk. The name derives from the six aspects considered: (1) Capital adequacy, (2) Asset quality, (3) Management capability, (4) Earnings sufficiency, (5) Liquidity position, and (6) Sensitivity to market risk.

Capital adequacy is a concept that concerns whether a bank's level of capital is sufficient for its financial position to weather potential losses. Adequacy of capital is assessed relative to the bank's risk-weighted assets (RWA). Under Basel III, Tier 1, capital consists of common equity (less intangibles and deferred tax assets) and subordinated instruments with no specified maturity and no contractual interest/dividend. Tier 2 capital consists of subordinated instruments with maturity exceeding five years (at original issuance). Basel III recommends minimum common equity Tier 1 of 4.5% of RWA, total Tier 1 of 6% of RWA, and total capital (Tier 1 and 2) of 8% of RWA.

Asset quality considers not only the liquidity and credit quality of the securities and loans that a bank holds, but also takes into account how diversified these assets are. Off-balance sheet items including guarantees, unused lines of credit, and letters of

credit should also be evaluated. Analysis of loan loss provisions relative to actual loss behavior may provide key insights.

Management capabilities assesses a bank management's capacity to manage risks while at the same time taking advantage of suitable opportunities for new business. Quality of corporate governance, compliance with applicable regulations, risk-management systems, and quality of internal controls all form part of the analysis.

Earnings measures the amount of return that a bank generates, in comparison to the cost of the bank's capital. The quality of the bank's earnings is evaluated by looking at trends, whether the accounting estimates are biased, and whether earnings are derived from recurring sources.

Liquidity compares the quantity of liquid assets that a bank holds versus the bank's required cash outflows in the near future.

Sensitivity to market risk considers the extent to which a bank's financial position and earnings could be negatively impacted by shifts in the markets (most commonly, changes in stock prices, interest rate, currency exchange rates, and commodity prices).

Other Factors to Consider in Analyzing a Bank

Aside from the CAMELS components, other factors to consider in analyzing a bank include off-balance-sheet liabilities, support by government, risks disclosed, the competitive environment, corporate culture, segmental data, foreign exchange exposure, and the mission of the bank.

Factors to Consider in Analyzing an Insurance Company

Two major categories of insurance firms are **Life and Health (L&H)** and **Property and Casualty (P&C)**.

L&H insurance policies are generally long-term contracts, while P&C policies are likely to be short term, spanning only a year or so.

The claims of an L&H insurer are generally straightforward to predict accurately in aggregate, while P&C insurer claims are more difficult to foresee.

An insurance company's revenues come from two sources: (1) premiums collected from the purchasers of insurance, and (2) investment returns earned on funds collected as premiums and held to pay out as benefits.

When analyzing an insurance company (either L&H or P&C), key characteristics to consider are capitalization, liquidity, business profile, characteristics of earnings, and returns on investments.

When analyzing the profitability of a P&C insurance company, loss reserves and the combined ratio should additionally be considered.

EVALUATING QUALITY OF FINANCIAL REPORTS

Cross-Reference to CFA Institute Assigned Reading #12

It is important for an analyst to evaluate the quality of a company's financial reports before relying on them for investment decision making.

High-quality reporting provides decision-useful information, which is information that is accurate as well as relevant. High-quality earnings are sustainable and meet the required return on investment. High-quality earnings assume high-quality reporting.

The conceptual framework for assessing the quality of a company's reports entails answering two questions:

1. Are the underlying financial reports GAAP compliant and decision-useful?
2. Are the earnings of high quality?

Potential Problems that Affect the Quality of Financial Reports

Potential problems that affect the quality of financial reports can result from:

1. Measurement and timing issues, and/or
2. Classification issues.

Additionally, biased accounting and accounting for business combinations can compromise the quality of financial reports. *GAAP compliance is a necessary, but not sufficient, condition for high-quality financial reporting.*

Quantitative Models

The Beneish model is used to estimate the probability of earnings manipulation and is based on eight key variables. However, as managers become aware of the use of such models, they are likely to game the model's inputs. This concern is supported by an observed decline in the predictive power of the Beneish model over time.

High-Quality Earnings

Sustainable or persistent earnings are those that are expected to recur in the future. Earnings with a high proportion of nonrecurring items are considered to be nonsustainable (and, hence, low quality).

High-quality earnings are characterized by two elements:

1. Sustainable. High-quality earnings are expected to recur in future periods.
2. Adequate. High-quality earnings cover the company's cost of capital.

There are two major contributors to earnings manipulation:

1. Revenue recognition issues.
2. Expense recognition issues (capitalization).

Bill-and-hold sales, or channel stuffing, are examples of aggressive revenue recognition practices. Analysis of days' sales outstanding (DSO) and receivables turnover (over time

and compared to peers) is used to reveal red flags. Cost capitalization will result in an excessive asset base, which can be spotted by evaluation of the trend and comparative analysis of common-size balance sheets.

Mean Reversion in Earnings

Mean reversion in earnings, or the tendency of earnings at extreme levels to revert back to normal levels over time, implies that earnings at very high levels are not sustainable. Mean reversion is quicker for accruals-based earnings and faster still if such accruals are discretionary.

Evaluating the Earnings Quality of a Company

Indicators of Cash Flow Quality

High-quality cash flow means that the reported cash flow was high (i.e., good economic performance), and the underlying reporting quality was also high.

Elements to check for in the statement of cash flows:

- Unusual items or items that have not shown up in prior years.
- Excessive outflows for receivables and inventory due to aggressive revenue recognition.
- Provisions for, and reversals of, restructuring charges.

Indicators of Balance Sheet Quality

High financial reporting quality for a balance sheet is evidenced by completeness, unbiased measurement, and clarity of presentation.

Completeness of a balance sheet can be compromised by the existence of off-balance sheet liabilities. Also, biased measurement may be present in the measurement of pension obligations, goodwill, investments, inventory, and other assets.

INTEGRATION OF FINANCIAL STATEMENT ANALYSIS TECHNIQUES

Cross-Reference to CFA Institute Assigned Reading #13

Financial Analysis Framework

The basic financial analysis framework involves:

1. Establishing objectives.
2. Collecting data.
3. Processing data.
4. Analyzing data.
5. Developing and communicating conclusions.
6. Following up.

Integration of FSA Techniques

1. Use the extended DuPont equation to examine the sources of earnings and performance.
2. Remove equity income from associates and the investment account to eliminate any bias.
3. Examine the composition of the balance sheet over time.
4. Determine if the capital structure can support future obligations and strategic plans by analyzing the components of long-term capital. Note that some liabilities don't necessarily result in an outflow of cash.
5. Segment disclosures are valuable in identifying the contribution to revenue and profit of each segment. Note the relationship between capital expenditures by segment and segment rates of return in order to evaluate capital spending decisions.
6. The balance sheet should be adjusted for off-balance-sheet financing activities.
7. Users must be aware of the proposed changes in accounting standards because of the financial statement effects and the potential impact on a firm's valuation. Earnings can be disaggregated into cash flow and accruals using either a balance sheet approach or a cash flow statement approach. For either measure, the lower the accruals ratio, the higher the earnings quality.
8. Earnings are considered higher quality when confirmed by cash flow. Cash flow can be compared to operating profit by adding back cash paid for interest and taxes to operating cash flow.
9. The standalone market value of a firm can be computed by eliminating the pro-rata market value of investments in associates. An implied P/E multiple can be computed by dividing the standalone market value by earnings not including equity income from associates.

Figure 9: Major Differences (in CFA Level II Curriculum) Between IFRS and U.S. GAAP Treatment

Topic Area	IFRS	U.S. GAAP
Intercorporate Investments		
Investment in associates	Fair value accounting only allowed for venture capital, mutual funds, and similar entities	Fair value accounting allowed for all
Acquisition method—goodwill computation	Partial or full goodwill allowed	Only full goodwill allowed
Goodwill impairment	1-step process	2-step process
Acquisition method—recognition of contingent assets	Not allowed	Allowed

Topic Area	IFRS	U.S. GAAP
Pension Accounting		
Balance sheet and total periodic pension cost	Both IFRS and U.S. GAAP report funded status on the balance sheet. Total periodic pension cost is same for both IFRS and GAAP, but the allocation to income statement and OCI differs.	
Pension cost in P&L vs. OCI	1. Prior service cost expensed 2. Discount rate = expected rate of return 3. Remeasurements in OCI and not amortized	1. Prior service cost in OCI and amortized 2. Expected rate of return does not have to be same as discount rate 3. Actuarial gains/losses in OCI and amortized using corridor approach

Topic Area	IFRS	U.S. GAAP
Multinational Operations		
Subsidiaries in hyperinflationary economies	Restate LC financial statements for inflation (nonmonetary assets/ liabilities indexed to inflation). Convert restated financial statements at current rate. Purchasing power gains/losses in income statement.	Use temporal method

FINANCIAL STATEMENT MODELING

Cross-Reference to CFA Institute Assigned Reading #14

Forecasting Revenues

Bottom-up analysis starts with analysis of an individual company or reportable segments of a company. **Top-down analysis** begins with expectations about a macroeconomic variable, often the expected growth rate of nominal GDP. A **hybrid analysis** incorporates elements of both top-down and bottom-up analysis.

When forecasting revenue with a *growth relative to GDP growth approach*, the relationship between GDP and company sales is estimated, and then company sales growth is forecast based on an estimate for future GDP growth. The *market growth and market share approach* begins with an estimate of industry sales (market growth), and then company sales are estimated as a percentage (market share) of industry sales. Forecast revenue then equals the forecasted market size multiplied by the forecasted market share.

Forecasting Expenses

COGS is primarily a variable cost and is often modeled as a percentage of estimated future revenue. Expectations of changes in input prices can be used to improve COGS estimates. The R&D and corporate overhead components of SG&A are likely to be stable over the short term, while selling and distribution costs will tend to increase with increases in sales.

A company with **economies of scale** will have lower costs and higher operating margins as production volume increases and should exhibit positive correlation between sales volume and margins. Economies of scale in an industry are evidenced by the existence of lower costs (proportional to revenues) for larger companies in an industry as compared to their smaller peers.

Increases in input costs will increase COGS unless a company has hedged the risk of input price increases with derivatives or contracts for future delivery. Vertically integrated companies are likely to be less affected by increasing input costs. The effect on sales of increasing product prices to reflect higher COGS will depend on the elasticity of demand for the products and on the timing and amount of competitors' price increases.

Some advances in technology decrease costs of production, which will increase profit margins (at least for early adopters). Other advances in technology will result in either improved substitutes or wholly new products. One way for an analyst to model the introduction of new substitutes for a company's products is to estimate a **cannibalization factor**—the percentage of the market for the existing product that will be taken by the new substitute.

The primary determinants of gross interest expense are the amount of debt outstanding (gross debt) and interest rates. Net interest expense is gross interest expense minus interest income on cash and short-term debt securities owned.

Forecasting Balance Sheet Items

Certain balance sheet items (e.g., accounts receivable, inventory, accounts payable) can be estimated based on their historical relationships with income statement items. Property, plant, and equipment (PP&E) forecasts may be improved by analyzing capital expenditures for maintenance separately from capital expenditures for growth.

Return on Invested Capital (ROIC)

Forecasts resulting in higher ROIC than a firm's peers can be the result of a competitive advantage, a favorable force (from Porter's five force analysis), or inappropriate historical financial data having been used as a basis for the forecast.

Estimating Long-Term Growth Rate

Terminal value estimates are very sensitive to estimates of long-term growth rate. Analysts should be on the lookout for **inflection points**: times when growth trajectory is expected to change significantly.

CORPORATE ISSUERS

Topic Weight on Exam	5%–10%
SchweserNotes™ Reference	Book 2, Pages 221–300

ANALYSIS OF DIVIDENDS AND SHARE REPURCHASES

Cross-Reference to CFA Institute Assigned Reading #15

Dividend Types

Regular cash dividends are periodic cash dividends. **Special dividends** are irregular and supplement regular dividends. **Liquidating dividends** occur when dividends in excess of cumulative retained earnings are paid or when all or part of the firm is sold. **Stock dividends** and **stock splits** are noncash dividends paid by issuance of additional stock. Because stock dividends and splits do not entail an outflow of cash, they do not affect the current ratio, quick ratio, or leverage ratios.

Dividend Theories

Merton Miller and Franco Modigliani (MM) maintain that *dividend policy* is irrelevant, as it has no effect on the price of a firm's stock or its cost of capital. MM's argument of dividend irrelevance is based on their concept of *homemade dividends*. Dividend preference theory says investors prefer the certainty of current cash to future capital gains. Tax aversion theory states that investors are tax averse to dividends and would prefer companies instead buy back shares, especially when the tax rate on dividends is higher than the tax rate on capital gains.

Signaling Effect

The signaling effect of dividend changes is based on the idea that dividends convey information about future earnings from management to investors (who have less information about a firm's prospects than management). In general, unexpected increases are good news and unexpected decreases are bad news as seen by U.S. investors.

Taxation

A **double-taxation system** is used in the United States to tax dividends paid. Earnings are taxed at the corporate level regardless of whether they are distributed as dividends, and dividends are taxed again at the shareholder level.

$$\text{effective rate} = \text{corporate tax rate} + (1 - \text{corporate tax rate}) \times (\text{individual tax rate})$$

A **split-rate** corporate tax system taxes earnings distributed as dividends at a lower rate than earnings that are retained. The effect is to offset the higher (double) tax rate

applied to dividends at the individual level.

Under an **imputation tax system**, taxes are paid at the corporate level but are attributed to the shareholder, so that *all taxes are effectively paid at the shareholder rate.*

Stable Dividend Policy

A firm with a stable dividend policy could use a target payout adjustment model to gradually move towards its target payout.

$$\text{expected increase in dividends} = [(\text{expected earnings} \times \text{target payout ratio}) - \text{previous dividend}] \times \text{adjustment factor}$$

where:

$$\text{adjustment factor} = 1 \,/\, \text{number of years over which the adjustment in dividends will take place}$$

Share Repurchase Methods

Repurchase methods include **open market** transactions (most flexible), **tender offers** (very quick to complete), **Dutch auction** (not as quick), and **direct negotiation** to purchase from a major shareholder (often used in greenmail transactions).

Impact of Repurchase on EPS and BVPS

A repurchase financed with idle cash will lead to an increase in EPS post-repurchase, as long as the earnings yield exceeds the yield on idle cash. A repurchase funded through additional debt will lead to an increase in EPS if the after-tax borrowing cost is less than the earnings yield. However, a repurchase funded by additional borrowing leads to higher leverage and, hence, higher cost of capital.

If the price paid is higher (lower) than the pre-repurchase BVPS, the BVPS will decrease (increase).

Share Repurchase Rationale

There are five common rationales for share repurchases (versus dividends):

1. Potential tax advantages. When capital gains are taxed favorably compared to dividends.
2. Share price support/signaling. Management wants to signal better prospects for the firm.
3. Added flexibility. Reduces the need for "sticky" dividends in the future.
4. Offsets dilution from employee stock options.
5. Increases financial leverage by reducing equity in the balance sheet.

Dividend Coverage Ratios

The two most important predictors of dividend reliability are:

$$\text{dividend coverage ratio} = \text{net income} \,/\, \text{dividends}$$

$$\text{FCFE coverage ratio} = \text{FCFE} \,/\, (\text{dividends} + \text{share repurchases})$$

ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) CONSIDERATIONS IN INVESTMENT ANALYSIS

Cross-Reference to CFA Institute Assigned Reading #16

Global Variations in Ownership Structures

Shareholder ownership is usually categorized as concentrated, dispersed, or a hybrid.

Dispersed ownership indicates that none of the many shareholders has control over the corporation.

Concentrated ownership means that controlling shareholders (i.e., an individual or group) can exercise control over the company. The controlling shareholders can be either minority or majority shareholders.

Vertical (also known as pyramid) ownership refers to a structure where a company has a controlling interest in multiple holding companies, and those holding companies own controlling interests in operating companies. Horizontal ownership refers to companies with shared business interests that cross-hold the shares of each other.

Dual-class shares give superior (or sole) voting rights to one share class, and lesser (or no) voting rights to another.

The board of directors of a company can be structured either as a single-tier board consisting of internal (executive) and external (nonexecutive) directors, or a two-tiered board where the management board is overseen by a supervisory board.

Corporate Governance Effectiveness

The situation where the CEO is also the company's chairperson of the board is called **CEO duality**. CEO duality raises the concern that, relative to having independent chairperson and CEO roles, oversight and monitoring roles of the board could be compromised.

Identifying and Evaluating ESG Risk Exposures

ESG information and metrics are inconsistently reported by companies, and such disclosure is voluntary. This makes it difficult for analysts to identify useful and relevant ESG factor data.

Materiality in ESG refers to an issue that could impact a firm's securities, performance, or operations.

There are three main approaches for identifying a company's ESG factors: (1) ESG data providers, (2) industry organizations, and (3) proprietary methods.

In fixed-income analysis, ESG considerations are primarily concerned with downside risk. In equity analysis, ESG is considered both in regard to upside opportunities and downside risk.

Evaluating a Company's ESG Risk Exposures

Analysts evaluate ESG factors and then make corresponding adjustments to estimate a discount rate or risk premium. ESG factor adjustments related to a firm's income statement and statement of cash flows relate to projected revenues, costs, margins, earnings, capex, or other line items. ESG adjustments to a firm's balance sheet often involve evaluating potential impairment of the firm's assets.

COST OF CAPITAL: ADVANCED TOPICS

Cross-Reference to CFA Institute Assigned Reading #17

Factors That Impact the Cost of Capital

Top-down (i.e., macro) factors that affect the cost of capital include capital availability, market conditions, legal and regulatory considerations, and tax jurisdiction.

Bottom-up (i.e., company-specific) factors that affect the cost of capital include business or operating risk, asset nature and liquidity, financial strength and profitability, and security features.

Methods Used to Estimate the Cost of Debt

If a company's debt is publicly traded, the yield to maturity for the firm's longest-maturity straight debt outstanding is our best estimate of the firm's cost of debt. If a company's debt is not traded (or is thinly traded), we can use matrix pricing, based on the yields on traded securities with the same maturity and credit ratings. If the debt is not credit rated, we can use financial ratios of the company such as interest coverage or financial leverage to *infer* a credit rating on the debt.

For a finance lease, the **rate implicit in the lease (RIIL)** is the cost of debt. The RIIL can be estimated as the internal rate of return (IRR) that equates the fair value of the leased asset (plus the lessor's direct initial costs) to the present value of the lease payments plus the residual value.

For foreign borrowers, a **country risk premium** (such as the yield difference between foreign sovereign debt and a benchmark government security) should be added.

Approaches to Estimating Equity Risk Premium

There are two types of estimates of the equity risk premium (ERP): historical estimates and forward-looking estimates.

A **historical estimate of the ERP** consists of the difference between the historical mean return for a broad-based equity market index and a risk-free rate, over a given time period. Survivorship bias and nonstationarity in the time series are concerns with historical estimates.

A **forward-looking estimate of the ERP** can be a survey estimate, an estimate based on the dividend discount model (DDM), or an estimate based on macroeconomic variables.

Grinold-Kroner model: $ERP = [DY + \Delta P/E + i + G + \Delta S] - r_f$

Estimating Required Return on Equity

Cost of Equity Based on DDM

cost of equity (r_e) = dividend yield (DY) + capital gains yield (CGY)

Fama–French Model

Includes a size premium (SMB), and a value premium (HML).

required return of stock = $r_f + \beta_1 ERP + \beta_2 SMB + \beta_3 HML$

Five-Factor Fama–French Extended Model

Adds profitability (RMW) and investment factor (CMA).

required return = $r_f + \beta_1 ERP + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA$

Required Return for Private Companies

Can be calculated using an expanded CAPM that includes risk premiums appropriate to a private company: size premium (SP), industry risk premium (IP), and specific company risk premium (SCRP).

required return = $r_f + \beta_{peer} \times ERP + SP + IP + SCRP$

Alternatively, the build-up approach adds to the risk-free rate the ERP, and any additional risk premiums as applicable, for size, industry, and company-specific characteristics.

required return = $r_f + ERP + SP + SCRP$

Factors Affecting SCRP

Qualitative factors: Industry classification and competitive position within the industry; corporate governance quality; asset nature and type; customer, supplier, and geographical concentration; and management quality.

Quantitative factors: Operating and financial leverage, and earnings and cash flow volatility.

CORPORATE RESTRUCTURING

Cross-Reference to CFA Institute Assigned Reading #18

Corporate Restructurings and Motivations

Major corporate changes include **investment** (equity, joint venture, acquisition), **divestment** (sale, spin-off), and **restructuring** (cost and balance sheet).

Investment **motivations** include realizing synergies, increasing growth, improving company capabilities, acquiring resources and talent, or acquiring an undervalued target.

Divestment may be motivated by liquidity needs, high valuation, refocusing on a core business, or compliance with regulatory requirements.

Motivations behind restructuring may be financial challenges (including bankruptcy and liquidation) or simply to improve the return on capital.

Initial Evaluation of a Corporate Restructuring

The steps involved in analysis of an announced corporate action include:

1. Initial evaluation.
2. Preliminary evaluation.
3. Modeling and valuation.
4. Updating investment thesis.

Materiality is evaluated along the dimensions of size and fit. Transactions exceeding 10% of enterprise value, revenues, or market cap are considered material.

Valuation of Restructured Companies

Comparable company analysis (CCA) uses relative valuation metrics for similar firms to estimate market value, then adds a takeover premium to determine a fair price for the acquirer to pay for the target. Since CCA does not incorporate the takeover premium directly, it is commonly used to value spin-offs as opposed to acquisitions.

Comparable transaction analysis (CTA) is similar to CCA but uses actual takeover transaction prices (as opposed to market trading prices). Since transaction prices already include a takeover premium, it is not necessary to estimate an add-on separately.

Effect of Corporate Restructurings on an Issuer's EPS, Net Debt to EBITDA Ratio, and WACC

Evaluation of corporate transactions involve preparing pro forma financial statements that incorporate the terms of the transactions. Ratios are then calculated using these pro forma statements. Analysts should also estimate the impact of the transaction on the WACC of the company.

Evaluating Corporate Restructurings

In evaluating an equity investment, an analyst must recognize that income from associates is recorded in the investor's income statement. The consideration paid is used to adjust pro forma balance sheets.

A joint venture announcement is approached similarly: an analyst should calculate the gains to the firms involved, as well as the impact the transaction will have on the ratios of the two companies. Accounting for a joint venture is similar to that of equity investments.

Compared to other kinds of investments, acquisitions require a higher capital investment but allow for a controlling interest in the investee.

EQUITY VALUATION

Topic Weight on Exam	10%–15%
SchweserNotes™ Reference	Book 3, Pages 1–215

EQUITY VALUATION: APPLICATIONS AND PROCESS

Cross-Reference to CFA Institute Assigned Reading #19

Intrinsic value is the estimate of an asset's value that would be made by someone who has complete understanding of the characteristics of the asset and its issuing firm. To the extent that market prices are not perfectly (informationally) efficient, they may diverge from intrinsic values. The difference between an analyst's estimate of a security's intrinsic value and its market price has two components—the difference between the security's *actual* intrinsic value and its market price, and the difference between the security's actual intrinsic value and the analyst's estimate of the intrinsic value:

$$IV_{analyst} - price = (IV_{actual} - price) + (IV_{analyst} - IV_{actual})$$

The **going concern assumption** is simply the assumption that a company will continue to operate as a business (as opposed to going out of business). **Liquidation value** is an estimate of what the assets of the firm would bring if sold separately, net of the company's liabilities.

Equity valuation is the process of estimating the value of an asset by (1) using a model based on the variables the analyst believes determine the fundamental value of the asset or (2) comparing it to the observable market value of "similar" assets. Equity valuation models are used by analysts in a number of ways including stock selection, forecasting the value impact of corporate actions, providing fairness opinions, communication with analysts and investors, valuation of private firms, portfolio management, and asset allocation.

The **five elements of industry structure** that determine the competitive environment in which firms compete and drive successful competitive strategy (as developed by Professor Michael Porter) are:

1. Threat of new entrants in the industry.
2. Threat of substitutes.
3. Bargaining power of buyers.
4. Bargaining power of suppliers.
5. Rivalry among existing competitors.

The basic building blocks of equity valuation come from accounting information contained in the firm's reports and releases.

Quality of earnings issues can be broken down into several categories and may be addressed only in the footnotes and disclosures to the financial statements:

1. Accelerating or premature recognition of income.
2. Reclassifying gains and non-operating income.
3. Expense recognition and losses.
4. Amortization, depreciation, and discount rates.
5. Off-balance-sheet issues.

Selecting an Appropriate Valuation Model

An **absolute valuation model** refers to one which estimates intrinsic value based on future earnings, cash flows, and risk. Dividend discount and free cash flow valuation models are examples of absolute valuation models.

A **relative valuation model** estimates the value of a security relative to market prices of other similar securities. Valuation based on price-to-earnings, price-to-cash flow, and price-to sales ratios of other securities or securities indexes are examples of relative valuation models.

In **choosing a valuation model**, the analyst should consider the purpose of the analysis and the characteristics of the firm, including whether it pays dividends, the stability of its cash flows, how well its earnings growth can be estimated, and the nature of its assets.

DISCOUNTED DIVIDEND VALUATION

Cross-Reference to CFA Institute Assigned Reading #20

DCF Methods

Discounted cash flow (DCF) valuation is based on the idea that the value today of any security is the discounted value of all future cash flows.

Dividend discount models (DDMs). The DDM defines cash flow as dividends to be received in the future. This is based on the idea that, over time, earnings and dividends will converge. The DDM is most appropriate for mature and profitable firms that are not engaged in a fast-growing segment of the economy, or for large, diversified portfolios like the S&P 500. Use the DDM for valuation problems with the following characteristics:

- The firm has a dividend history.
- The dividend policy is consistent and related to earnings.
- The perspective is that of a minority shareholder.

Free cash flow (FCF) *models.* Cash flow from a security can also be defined as free cash flow. Two versions of FCF valuation exist: FCF to the firm (FCFF) and FCF to equity (FCFE). FCFF is the cash flow generated by the firm above that required to be reinvested to maintain current operations. FCFE is FCFF minus debt service and preferred dividends. FCF valuation is appropriate when the following characteristics exist:

- The firm does not have a stable dividend policy.
- The firm has a dividend policy that is not related to earnings.
- The firm's FCF is related to profitability.
- The perspective is that of a controlling shareholder.

Residual income (RI). Residual income refers to the amount of earnings during the period that exceed the investor's required earnings. Think of residual income as *economic profit*. In this framework, the value of the firm's equity is the firm's book value plus the present value of all future residual income. The RI method can be difficult to apply because it requires an in-depth analysis of the firm's accounting accruals.

The RI method is most appropriate under the following conditions:

- The firm does not have a dividend history.
- The firm's FCF is negative.
- It is a firm with transparent and high quality accounting.

In all cases, you will have to forecast the future cash flows (dividends, free cash flow, or residual income), determine the appropriate discount rate, and discount the cash flows to obtain the value of the firm. For the DDM, FCFE, and RI methods, the appropriate discount rate is the cost of equity. In general, there are three methods for determining the cost of equity:

1. The CAPM:

$$E(r) = r_f + \{\beta \times [E(r_m) - r_f]\}$$

2. Multifactor models such as the Arbitrage Pricing Theory or the Fama-French model.
3. The build-up method, such as adding a risk premium to the firm's bond yield.

For the FCFF model, the appropriate discount rate is the weighted average cost of capital (WACC).

Now let's turn to the specifics of the valuation methods.

There are four versions of the multiperiod DDM: (1) the Gordon growth model, (2) 2-stage growth model, (3) H-model, and (4) 3-stage growth model. We will review only the first three, since the 3-stage model is an extension of the 2-stage version.

Gordon Growth Model

The *Gordon growth model* assumes that dividends will grow at a constant rate forever. The formula is as follows:

$$V_0 = \frac{D_0(1+g)}{r-g} = \frac{D_1}{r-g}$$

The constant growth rate in dividends and earnings is g. Note that the value today, V_0, is dependent on the amount of the dividend one period from today, D_1. The model also assumes that r is greater than g. You can solve the Gordon model for either r or g to determine the required return or growth rate implicit in the current market price.

PROFESSOR'S NOTE

If you're using the Gordon model on the exam, make sure you have next year's dividend, D_1. If you are given the current dividend, D_0 , you can get next year's dividend as: $D_1 = D_0 \times (1 + g)$.

A related construct is the *present value of growth opportunities* (PVGO). This simply says that the value of the stock today is equal to its nongrowth value (E_1 / r) plus the PVGO:

$$V_0 = \frac{E_1}{r} + PVGO$$

The main use of this idea is to plug in the current market price as V_0 and calculate the PVGO implied in the market price (large PVGO indicates high expected growth).

The Gordon growth model is most appropriate for mature, stable firms. The limitations of the Gordon model include the following:

- Valuations are very sensitive to estimates of *r* and *g*.
- The model assumes that the firm is paying dividends now, or will be during the foreseeable future.
- Unpredictable growth patterns from some firms make using the model difficult.

Two-Stage Growth Model

The multistage models are somewhat more complex. Basically, the multistage models (e.g., the 2-stage growth model and the H-model) *assume that there is some temporary short-term growth period followed by a stable long-term growth period*. The 2-stage model normally assumes that the firm will experience a high rate of growth for the next few years followed by low growth for eternity.

The value of the stock is the present value of the dividends during the high-growth period plus the present value of the terminal value. The terminal value can be estimated using the Gordon growth model or a market multiple approach.

H-Model

The H-model assumes that growth is currently high, but decreases at a linear rate toward the low-growth rate. Once the low-growth rate is reached, the H-model assumes that the low-growth rate will prevail forever. The difference between the two models is how the growth rate changes from high growth to low growth. The 2-stage model assumes that the change happens at one point in time. The H-model assumes that the growth rate declines in a linear fashion from the current (high) growth rate to the long-term (stable) growth rate over *t* years.

The approximate value of a firm's equity using the H-model is:

$$V_0 = \frac{D_0 \times (1 + g_L)}{r - g_L} + \frac{D_0 \times H \times (g_S - g_L)}{r - g_L}$$

where:

$H = \left(\frac{t}{2}\right)$ = half-life (in years) of high-growth period

t = length of high-growth period

g_S = short-term growth rate

g_L = long-term growth rate

r = required return

Note that the second term is the value of growth in excess of g_L and that the first is the value of the firm with constant growth of g_L.

Solving for Required Return

You can use any of the models to solve for the required rate of return given the other model inputs. For the multistage models, the algebra gets complex and is very unlikely to show up on the exam.

For the Gordon (or stable growth) model, solving for return yields:

$$r = \frac{D_1}{P_0} + g$$

This is a handy tool for backing into the required rate of return.

The Sustainable Growth Rate

The *sustainable growth rate* (SGR) is defined as the rate that earnings (and dividends) can continue to grow indefinitely, given that a firm's capital structure is unchanged and it doesn't issue any new equity. SGR can be derived from the relationship between the firm's retention rate and ROE as determined by the DuPont formula:

$$g = \left(\frac{\text{net income} - \text{dividends}}{\text{net income}}\right) \times \left(\frac{\text{net income}}{\text{sales}}\right) \times \left(\frac{\text{sales}}{\text{total assets}}\right) \times \left(\frac{\text{total assets}}{\text{stockholders' equity}}\right)$$

This has also been called the *PRAT model*, where SGR is a function of the profit margin (P), the retention rate (R), the asset turnover (A), and the degree of financial leverage (T). Unless otherwise instructed on the exam, use beginning-of-period balance sheet value to calculate SGR and to construct the DuPont model.

FREE CASH FLOW VALUATION

Cross-Reference to CFA Institute Assigned Reading #21

Free cash flow to the firm (FCFF) is the cash available to all of the firm's investors, including common stockholders, preferred stockholders, and bondholders after the firm buys and sells products, provides services, pays its cash operating expenses, and makes short- and long-term investments. *Free cash flow to equity* (FCFE) is the cash

available to the common stockholders after funding capital requirements, working capital needs, and debt financing requirements.

The FCFE/FCFF framework is analogous to the DDM framework. The main difference is that now we must be very careful to correctly calculate FCFF and FCFE from the income statement or the statement of cash flows, and we must make sure that we are using the correct discount rate (use the equity cost of capital with FCFE and the WACC with the FCFF).

Use the FCF model instead of DDM if the following conditions apply:

- The firm does not pay cash dividends.
- Dividend policy does not reflect the firm's long-run profitability.
- The firm is a take-over target (because FCF models take a control perspective).

Free Cash Flow to the Firm

There are four definitions for FCFF depending on the data given. Unfortunately, we are going to advise you to know all four (if that's just too much, then you should concentrate on the first and the last). Assuming that the only noncash charge is depreciation, the four definitions are as follows:

FCFF from NI: $\text{FCFF} = \text{NI} + \text{dep} + [\text{interest} \times (1 - \text{tax rate})] - \text{FCInv} - \text{WCInv}$

FCFF from EBIT: $\text{FCFF} = [\text{EBIT} \times (1 - \text{tax rate})] + \text{dep} - \text{FCInv} - \text{WCInv}$

FCFF from EBITDA: $\text{FCFF} = [\text{EBITDA} \times (1 - \text{tax rate})] + (\text{dep} \times \text{tax rate}) - \text{FCInv} - \text{WCInv}$

FCFF from CFO: $\text{FCFF} = \text{CFO} + [\text{interest} \times (1 - \text{tax rate})] - \text{FCInv}$

where:
FCInv – net investment in fixed capital (commonly called capex)
WCInv – net investment in working capital (excluding cash)
EBITDA = earnings before interest, taxes, depreciation, and amortization

Free Cash Flow to Equity

We have four formulas for calculating FCFE:

FCFE from FCFF: $\text{FCFE} = \text{FCFF} - [\text{interest} \times (1 - \text{tax rate})] + \text{net borrowing}$

FCFE from NI: $\text{FCFE} = \text{NI} + \text{dep} - \text{FCInv} - \text{WCInv} + \text{net borrowing}$

FCFE from CFO: $\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}$

FCFE with target debt ratio:
$\text{FCFE} = \text{NI} - [(1 - \text{DR}) \times (\text{FCInv} - \text{dep})] - [(1 - \text{DR}) \times \text{WCInv}]$

where DR is the target debt-to-asset ratio.

It is *imperative* that you know how to calculate FCFF and FCFE. This looks like a formidable task (and it is), but if you look at the accounting relationships, you'll see that there is a lot of overlap between the formulas. Also, note that you use these formulas to calculate FCFF and FCFE given the accounting inputs.

Dividends, share repurchases, and share issues have no effect on FCFF and FCFE; leverage changes have only a minor effect on FCFE and no effect on FCFF.

Single-Stage FCFF/FCFE Models

Valuation using FCFF and FCFE is very similar to valuation using the DDMs. Let's begin with single-stage valuation. The formulas (which should look familiar) are as follows:

$$\text{For FCFF valuation: firm value} = \frac{\text{FCFF}_1}{\text{WACC} - g}$$

$$\text{For FCFE valuation: equity value} = \frac{\text{FCFE}_1}{\text{required return on equity} - g}$$

Note that to find the value of the firm today, the numerator is next year's FCF (i.e., FCFF_1 and FCFE_1). *It is imperative that you use the correct discount rate with the correct formula.* Since the FCFF framework values the entire firm, the cost of capital from all sources must be used (i.e., WACC). FCFE values only the cash flows that belong to equity holders; hence, the equity discount rate, *r*, is appropriate (think CAPM).

Two-Stage FCFF/FCFE Models

The 2-stage FCF framework is also analogous to the 2-stage DDM framework.

Remember the following steps:

Step 1: Chart the FCFs in high-growth period.

Step 2: Use single-stage FCF model to calculate terminal value at end of high-growth period.

Step 3: Discount interim FCF and terminal value to time zero to find value; use WACC with FCFF to find firm value; use required return on equity with FCFE to find equity value.

PROFESSOR'S NOTE

The guiding principle behind DCF valuation is that the value of the security is simply the discounted value of all future cash flows.

MARKET-BASED VALUATION: PRICE AND ENTERPRISE VALUE MULTIPLES

Cross-Reference to CFA Institute Assigned Reading #22

Price multiples are ratios of a common stock's market price to some fundamental variable. The most common example is the price-to-earnings (P/E) ratio. A **justified price multiple** is what the multiple *should be* if the stock is fairly valued. If the actual multiple is greater than the justified price multiple, the stock is overvalued; if the

actual multiple is less than the justified multiple, the stock is undervalued (all else equal).

A price multiple can be justified based on one of two methods:

1. The justified price multiple for the **method of comparables** is an average multiple of similar stocks in the same peer group. The economic rationale for the method of comparables is the Law of One Price, which asserts that two similar assets should sell at comparable prices (i.e., multiples).
2. The justified price multiple for the **method of forecasted fundamentals** is the ratio of the value of the stock from a discounted cash flow (DCF) valuation model divided by some fundamental variable (e.g., earnings per share). The economic rationale for the method of forecasted fundamentals is that the value used in the numerator of the justified price multiple is derived from a DCF model that is based on the most basic concept in finance: value is equal to the present value of expected future cash flows discounted at the appropriate risk-adjusted rate of return.

The Price-to-Earnings (P/E) Ratio

The most common market multiple is the P/E ratio. The main argument in favor of P/E valuation is that earnings power, as measured by EPS, is the primary determinant of investment value. There are a few problems with using the P/E ratio as a valuation tool:

- Earnings can be negative, which makes the P/E meaningless.
- The volatile, transitory portion of earnings makes the interpretation of P/Es difficult for analysts.
- Management has considerable discretion over accounting choices that affect reported earnings.

The P/E ratio can be calculated on a *leading* or *trailing basis*. On a trailing basis, earnings over the last 12 months are used in the denominator. With a leading basis, next year's expected earnings are used in the denominator.

While the price is always the market price of a share of stock, the analyst must determine the EPS. Analysts frequently use normalized EPS rather than EPS from the most recent financial statements. There are two methods of normalization:

1. *Historical average EPS.* The EPS in the P/E ratio is the historical average from the most recent complete business cycle.
2. *Average ROE.* The EPS in the P/E ratio is the average ROE over the most recent complete business cycle times the current book value per share.

On the exam, you are most likely to be presented with a market multiple valuation question dealing with forecasted fundamentals (as opposed to the comparison sample method). In all cases we present here, *the "forecasted fundamentals method" is economics-talk for rearranging the DCF formulas to solve for the desired market-multiple relationship.* In most cases, this involves rearranging (and substituting into) the Gordon model. For the P/E ratio, if you substitute and rearrange, you get the formulas for the forecasted fundamental P/E ratio:

$$\text{justified leading P/E} = \frac{P_0}{E_1} = \frac{1-b}{r-g}$$

$$\text{justified trailing P/E} = \frac{P_0}{E_0} = \frac{(1-b)\times(1+g)}{r-g}$$

In both formulas, *b* is the retention ratio [so (1 – b) is the payout ratio]. You should be able to determine how changes in the variables in the formula impact the justified P/E. All else equal, the higher the required rate of return, the lower the P/E will be; the higher the growth rate, the higher the P/E will be.

The PEG Ratio

The PEG ratio is equal to the ratio of the P/E multiple to earnings growth:

$$\text{PEG ratio} = \frac{P/E}{g}$$

The implied valuation rule is that stocks with lower PEG ratios are undervalued relative to high-PEG stocks, assuming similar risk.

The Price-to-Book (P/B) Ratio

The P/B ratio is calculated as the market price per share divided by the book value per share (common stockholders' equity = total assets – total liabilities – preferred stock). The *advantages* of the P/B ratio include the following:

- Book value is usually positive, even when earnings are negative.
- Book value is more stable than EPS.
- Book value is an appropriate measure of net asset value (especially for firms such as financial institutions that hold liquid assets).

The *disadvantages* of the P/B ratio include the following:

- P/Bs can be misleading when there are significant size differences between firms.
- Book value is influenced by accounting choices/conventions.
- Inflation and technology can cause the book value and the market value of assets to differ significantly.

As with the P/E ratio, if we substitute into and rearrange the Gordon model, we can obtain a formula for the justified P/B:

$$\text{justified P/B} = \frac{ROE-g}{r-g}$$

The P/B increases as ROE increases. It also increases as the spread between ROE and *r* increases. Common adjustments to the book value include the exclusion of intangible assets such as goodwill. Since the book value forecasts are not widely disseminated like EPS forecasts, analysts typically use trailing book value when calculating P/Bs.

The Price-to-Sales (P/S) Ratio

The P/S ratio is calculated by dividing the firm's stock price by revenue per share. The *advantages* of the P/S ratio include the following:

- The ratio is meaningful even for distressed firms.
- Sales revenue is not easily manipulated.
- P/S ratios are not as volatile as P/E ratios.
- P/S ratios are particularly useful in valuing mature, cyclical, and zero-income (start-up) firms.

The *disadvantages* of using the P/S ratio include the following:

- High sales do not necessarily mean high profits or cash flows.
- The P/S ratio does not capture differences in the cost structure between firms.
- Revenue recognition practices still distort sales.

Allowing PM_0 to denote the trailing profit margin (defined as NI/sales), we can substitute into and rearrange the Gordon model to get the formula for the justified P/S ratio:

$$\text{justified P/S ratio} = \frac{\left(E_0/S_0\right) \times (1-b) \times (1+g)}{r-g}$$

$$= \text{net profit margin} \times \text{justified trailing P/E}$$

The P/S increases as the profit margin increases and as growth increases. The P/S ratio is usually calculated using trailing sales.

Price-to-Cash-Flow Ratios

Since value depends largely on the ability of the firm to generate cash, price-to-cash-flow multiples make intuitive sense. The *advantages* of using price-to-cash-flow multiples include the following:

- Cash flow is more difficult for managers to manipulate.
- Price-to-cash-flow is more stable than P/E.
- Price-to-cash-flow mitigates many concerns about the quality of reported earnings.

The *disadvantages* of price-to-cash-flow multiples include the following:

- Determining true cash flow from operations may be difficult.
- FCFE may be better than cash flow to the entire firm, but it's also more volatile.

But which measure of cash flow do we use? There are several cash flow measures with which you should be familiar:

- *Price-to-cash-flow (P/CF):* CF = NI + depreciation + amortization.
- *Price-to-adjusted CFO (P/CFO):* adjusted CFO = CFO + [(net cash interest outflow) × (1 − tax rate)].
- *Price-to-FCFE:* FCFE = CFO − FCInv + net borrowing.
- *Price-to-EBITDA:* EBITDA = earnings before interest, taxes, depreciation, and amortization.

Theoretically, FCFE is the preferred way to define cash flow. However, FCFE is also more volatile than traditional cash flow. EBITDA is a measure of cash flow to all providers of capital (i.e., both debt and equity). Hence, it may be better suited to valuing

the entire firm rather than just the equity stake. Analysts typically use trailing cash flows when calculating price-to-cash-flow ratios.

Methods of Comparables

The basic idea of the method of comparables is to compare a stock's price multiple to the benchmark. *Firms with multiples below the benchmark are undervalued, and firms with multiples above the benchmark are overvalued.*

However, the fundamentals of the stock should be similar to the fundamentals of the benchmark before we can make direct comparisons and draw any conclusions about whether the stock is overvalued or undervalued. In other words, we have to ensure that we're comparing apples to apples. That's why the fundamental variables (i.e., the fundamentals) that affect each multiple are important in applying the method of comparables.

RESIDUAL INCOME VALUATION

Cross-Reference to CFA Institute Assigned Reading #23

Residual income, or economic profit, is equal to the net income of a firm less a charge that measures stockholders' opportunity costs in generating that income. That is, residual income recognizes that accounting profits actually overstate economic profit since the cost of the capital committed to the firm is not included in the calculation of accounting profit (note the similarities to our discussion of EVA®). Residual income is calculated as follows:

RI = net income − equity charge

where:
equity charge = equity capital × cost of equity

Residual Income Model Valuation

The residual income model can be used in a valuation setting. Residual income breaks the firm value into two components:

1. Adjusted current book value of equity.
2. Present value of expected future RI.

Under the residual income model, the intrinsic value of the stock can be expressed as follows:

$$V_0 = B_0 + \left\{ \frac{RI_1}{(1+r)^1} + \frac{RI_2}{(1+r)^2} + \frac{RI_3}{(1+r)^3} + \ldots \right\}$$

where:
B_0 = current book value of equity
RI_t = $E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$
r = required return on equity
ROE = expected return on new investments (expected return on equity)

The *single-stage residual income model* assumes residual income grows at a constant rate (g) which is less than the required return on equity (r).

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g}\right]$$

Strengths and Weaknesses of the Residual Income Approach

The *strengths* of the residual income approach include the following:

- Terminal value does not dominate the valuation equation (as with DDM and FCFE approaches).
- Residual income uses available accounting data.
- Residual income is applicable to non-dividend-paying firms.
- Residual income focuses on economic profits.

The *limitations* of the residual income approach are as follows:

- The accounting data may be manipulated by management.
- The accounting data may require significant adjustment.
- The model assumes a clean surplus relationship (i.e., ending BV = beginning BV + earnings – dividends).

The model is most appropriate for non-dividend paying firms, firms with negative FCF for the foreseeable future, or firms with high uncertainty about the terminal value of the equity.

Accounting Issues

There are many accounting issues associated with the residual income approach. Any accounting procedure that results in a direct charge to equity (e.g., foreign currency translation adjustments and some pension adjustments, etc.) will cause the residual income approach to break down. If the residual income model shows up on the exam, the most likely accounting issues that you will have to deal with involve balance sheet adjustments. Common balance sheet adjustments that you may have to allow for include the following:

- Changing inventory value from LIFO to current value.
- Capitalization of operating leases.
- Pension asset/liability issues.
- Goodwill.

On the exam, make the adjustments to the balance sheet and then calculate the value of the stock with the residual income method.

Multistage Residual Income Model

To implement a multistage residual income model, forecast residual income over a short-term, high-growth horizon (e.g., five years) and then make some simplifying assumptions about the pattern of residual income growth over the long term after the high-growth phase. *Continuing residual income* is the residual income that is expected over the long term. In the multistage residual income model, intrinsic value is the sum of three components:

$$V_0 = B_0 + (\text{PV of interim high-growth RI}) + (\text{PV of continuing residual income})$$

Continuing residual income will continue beyond a specified earnings horizon depending on the fortunes of the industry, as well as on the sustainability of a specific firm's competitive prospects over the longer term. The projected rate at which residual income is expected to fade over the life cycle of the firm is captured by a persistence factor, which is between zero and one.

To simplify the model, we typically make one of the following assumptions about continuing residual income over the long term:

- Residual income is expected to persist at its current level forever.
- Residual income is expected to drop immediately to zero.
- Residual income is expected to decline to a long-run average level consistent with a mature industry.
- Residual income is expected to decline over time as ROE falls to the cost of equity (in which case residual income is eventually zero).

An analysis of the firm's position in its industry and the structure of the industry will be necessary to justify one of these assumptions. The third scenario is the most realistic if we assume that over time industry competition reduces economic profits to the point at which firms begin to leave the industry and ROE stabilizes at a long-run normal level. The strength of the persistence factor will depend partly on the sustainability of the firm's competitive advantage and the structure of the industry: the more sustainable the competitive advantage and the better the industry prospects, the higher the persistence factor.

PRIVATE COMPANY VALUATION

Cross-Reference to CFA Institute Assigned Reading #24

Private firms include sole proprietorships and privately held corporations (not publicly traded). Valuation of private firms is based on some of the same company-specific factors which influence the value of publicly traded firms, such as:

- Stage of lifecycle.
- Firm size.
- Influence of short term investors.
- Quality and depth of management.
- Management/shareholder overlap.
- Quality of financial and other information.
- Taxes.

The stock of private firms, however, will typically have less liquidity and more restrictions on marketability than publicly traded shares. Private firms also typically have more concentrated ownership of its equity.

Reasons for Valuing the Total Capital of Private Companies

There are three primary reasons for valuing the total capital and/or equity capital of private companies: (1) transaction-related valuations, (2) compliance-related valuations, and (3) litigation-related valuations.

Transaction-related valuations are necessary when selling or financing a firm.

- Venture capital financing.
- Initial public offering (IPO).
- Sale in an acquisition.
- Bankruptcy proceedings.
- Performance-based managerial compensation.

Compliance-related valuations are performed for legal or regulatory reasons and primarily focus on financial reporting and tax issues.

Litigation-related valuations may be required for shareholder suits, damage claims, lost profits claims, or divorce settlements.

Approaches to Private Company Valuation

- *Income approach.* Values a firm as the present value of its expected future income. Such valuation has many valuations and may be based on a variety of different assumptions.
- *Market approach.* Values a firm using the price multiples based on recent sales of comparable assets.
- *Asset-based approach.* Values a firm's assets minus its liabilities.

Estimating Normalized Earnings

Normalized earnings should exclude nonrecurring and unusual items. In the case of private firms with a concentrated control, there may be discretionary or tax-motivated expenses, excessive compensation, or payment of personal expenses by the firm that require adjustment when estimating normalized earnings. Many analysts also adjust for company-owned real estate, removing the revenues and expenses of the real estate from the income statement and putting in a market-based estimate of rental cost of real estate used in the company's operations. The value of the real estate is then added to the income-based value of the firm as if owned real estate is all a non-operating asset of the firm. These adjustments can be quite significant when the firm is small.

Strategic and Nonstrategic Buyers

A transaction may be either strategic or financial (nonstrategic). In a strategic transaction, valuation of the firm is based in part on the perceived synergies of the target with the acquirer's other assets. A financial transaction assumes no synergies, as when one firm buys another in a dissimilar industry.

Forms of the Income Approach to Valuation

Free cash flow approach. Estimated future cash flows are discounted to present value using a discount rate that reflects the risks associated with the cash flows.

Capitalized cash flow approach. Uses a cap rate to estimate the value of the firm based on some measure of earnings or cash flow. The cap rate is equal to the required rate of return minus the growth rate.

Excess earnings approach. Excess earnings are firm earnings minus the earnings required to provide the required rate of return on working capital and fixed assets. The value of intangible assets can be estimated as the present value of the (growing) stream of excess earnings.

Discount Rate Estimation

Estimating the discount rate in a private firm valuation can be quite challenging for the following reasons.

- *Size premiums.* Size premiums are often added to the discount rates for small private companies. Estimating this premium using small public firm data may be biased upward by the fact many of the small firms in the sample are experiencing financial distress.
- *Availability and cost of debt.* A private firm may have less access to debt financing than a public firm. Because equity capital is usually more expensive than debt and because the higher operating risk of smaller private companies results in a higher cost of debt as well, WACC will typically be higher for private firms.
- *Acquirer versus target.* When acquiring a private firm, some acquirers will incorrectly use their own (lower) cost of capital, rather than the higher rate appropriate for the target, and arrive at a value for the target company that is too high.
- *Projection risk.* Because of the lower availability of information from private firms and managers who are inexperienced at forecasting, that analyst should increase the discount rate used.
- Management may not be experienced with forecasting and may underestimate or overestimate future earnings, requiring adjustment by the analyst. Such adjustments are highly subjective, however.
- *Lifecycle stage.* It is particularly difficult to estimate the discount rate for firms in an early stage of development. If such firms have unusually high levels of unsystematic risk, the use of the CAPM may be inappropriate. Although ranges of discount rates can be specified for the various lifecycle stages, it may difficult to classify the stage a firm is in.

CAPM Limitations

Using the CAPM, the expanded CAPM, and build-up methods to estimate discount rates for private firms may not be as straightforward as that for public firms.

- *CAPM.* Typically, beta is estimated from public firm data, and this may not be appropriate for private firms that have little chance of going public or being acquired by a public firm. Due to the differences between large public firms and small private firms, some U.S. tax courts have rejected the use of the CAPM for private firms.

- *Expanded CAPM.* This version of the CAPM includes additional premiums for size and firm-specific (unsystematic) risk.
- *Build-up method.* When it is not possible to find comparable public firms for beta estimation, the build-up method can be used. Beginning with the expected return on the market (beta is implicitly assumed to be one), premiums are added for small size, industry factors, and company specific factors.

Market Approaches to Valuation

- The *guideline public company method* uses the market values of similar publicly traded shares adjusted for differences in growth and risk between the two companies.
- The *guideline transactions method* uses the values from actual sales of controlling positions in either public or private companies.
- The *prior transaction method* uses sales prices from actual transactions in the subject company's shares.

Asset-Based Approaches to Valuation

The asset-based approach estimates the value of firm equity as the fair value of its assets minus the fair value of its liabilities. It is generally not used for going concerns.

Control and Marketability

A controlling equity position is regarded as more valuable than a minority position, as it gives the owner the ability to determine company strategy and dividend policy. Shares that are more marketable (liquid) are more valuable than otherwise identical, less marketable shares.

When estimating share values relative to market or transactions prices for similar shares, adjustment must be made for differences in control and marketability. For example, comparable values are for publicly traded shares, should be reduced by a **discount for lack of marketability.** The size of a marketability discount can be estimated using the difference between the sales price of traded shares and restricted shares of the same company or the difference between pre-IPO and post-IPO sales prices of shares.

On the other hand, if the comparable value is for publicly traded shares (a minority position) and the analyst is valuing a controlling interest in a private company, he would add a **control premium** to the comparable's value. Of course, if the comparable value is for a controlling position and the analyst is valuing a minority position, a **discount for lack of control** would be appropriate.

FIXED INCOME

Topic Weight on Exam	10%–15%
SchweserNotes™ Reference	Book 4, Pages 1–132

THE TERM STRUCTURE AND INTEREST RATE DYNAMICS

Cross-Reference to CFA Institute Assigned Reading #25

This topic review discusses the theories and implications of the term structure of interest rates. In addition to understanding the relationships between spot rates, forward rates, yield to maturity, and the shape of the yield curve, be sure you become familiar with concepts like the *z*-spread, the TED spread, and the MRR-OIS spread and key rate duration.

Spot Rates and Forward Rates

The spot rate for a particular maturity is equal to a geometric average of the current one-period spot rate and a series of one-period forward rates.

$$[1 + S_{(j+k)}]^{(j+k)} = (1 + S_j)^j[1 + f(j,k)]^k$$

When the spot curve is flat, forward rates will equal spot rates. When the spot curve is upward sloping (downward sloping), forward rate curves will be above (below) the spot curve, and the yield for a maturity of T will be less than (greater than) the spot rate S_T.

Evolution of Spot Rates in Relation to Forward Rates

If spot rates evolve as predicted by forward rates, bonds of all maturities will realize a one-period return equal to the one-period spot rate, and the forward price will remain unchanged.

Active bond portfolio management is built on the presumption that the current forward curve may not accurately predict future spot rates. Managers attempt to outperform the market by making predictions about how spot rates will evolve relative to the rates suggested by forward rate curves.

If an investor believes that future spot rates will be lower than corresponding forward rates, the investor will purchase bonds (at a presumably attractive price) because the market appears to be discounting future cash flows at "too high" a discount rate.

"Rolling Down the Yield Curve"

When the yield curve is upward sloping, bond managers may use the strategy of "rolling down the yield curve" or "riding the yield curve" to chase above-market returns. By holding long-maturity (relative to their investment horizon) bonds, the manager earns an excess return as the bond "rolls down the yield curve" (i.e., approaches maturity and

increases in price). As long as the yield curve remains upward sloping, this strategy will add to the return of a bond portfolio.

The Swap Rate Curve

The swap rate curve provides a benchmark measure of interest rates. It is similar to the yield curve except that the rates used represent the interest rates of the fixed-rate leg in an interest rate swap.

Market participants prefer the swap rate curve as a benchmark interest rate curve rather than a government bond yield curve for the following reasons:

- Swap rates reflect the credit risk of commercial banks rather than governments.
- The swap market is not regulated by any government.
- The swap curve typically has yield quotes at many maturities.

Institutions like wholesale banks are familiar with swaps and, as a result, often use swap curves (rather than other interest rate benchmarks) to value their assets and liabilities.

We define **swap spread** as the additional interest rate paid by the fixed-rate payer of an interest rate swap over the rate of the "on-the-run" government bond of the same maturity.

$$\text{swap spread} = (\text{swap rate}) - (\text{Treasury bond yield})$$

The *Z*-spread

The *Z*-spread is the spread that, when added to each spot rate on the yield curve, makes the present value of a bond's cash flows equal to the bond's market price. The *Z* refers to zero volatility—a reference to the fact that the *Z*-spread assumes interest rate volatility is zero. *Z*-spread is not appropriate to use to value bonds with embedded options.

The TED spread

$$\text{TED spread} = (\text{three-month MRR rate}) - (\text{three-month T-bill rate})$$

The TED spread is used as an indication of the overall level of credit risk in the economy.

The MRR-OIS Spread

The MRR-OIS spread is the amount by which the MRR rate (which includes credit risk) exceeds the overnight indexed swap (OIS) rate (which includes only minimal credit risk). The MRR-OIS spread is a useful measure of credit risk and provides an indication of the overall well-being of the banking system.

Traditional Theories of the Term Structure of Interest Rates

There are several traditional theories that attempt to explain the term structure of interest rates:

- **Unbiased expectations theory.** Forward rates are an unbiased predictor of future spot rates. Also known as the pure expectations theory.
- **Local expectations theory.** It preserves the risk-neutrality assumption only for short holding periods, while over longer periods, risk premiums should exist. This implies that over short time periods, every bond (even long-maturity risky bonds) should earn the risk-free rate.
- **Liquidity preference theory.** Investors demand a liquidity premium that is positively related to a bond's maturity.
- **Segmented markets theory.** The shape of the yield curve is the result of the interactions of supply and demand for funds in different market (i.e., maturity) segments.
- **Preferred habitat theory.** It is similar to the segmented markets theory, but recognizes that market participants will deviate from their preferred maturity habitat if compensated adequately.

Managing Bond Exposure to the Factors Driving the Yield Curve

We can measure a bond's exposure to the factors driving the yield curve in a number of ways:

1. **Effective duration.** Measures the sensitivity of a bond's price to parallel shifts in the benchmark yield curve.
2. **Key rate duration.** Measures bond price sensitivity to a change in a specific par rate, keeping everything else constant.
3. **Sensitivity to parallel, steepness, and curvature movements.** Measures sensitivity to three distinct categories of changes in the shape of the benchmark yield curve.

Key Economic Factors Driving Bond Yields

Two-thirds of the variation in short- and intermediate-term yields can be explained by inflation, with the remainder explained by GDP growth and monetary policy roughly equally.

Bond risk premium (also known as the term premium or duration premium) is a forward-looking expectation; it is the excess return (over the one-year risk-free rate) earned by investors for investing in long-term government bonds.

Monetary policy influences the shape of the yield curve. During economic expansions, to combat rising inflation, central banks may raise short-term rates, leading to a **bearish flattening** of the yield curve. During recessionary times, central banks may reduce short-term rates, leading to a **bullish steepening.** During periods of market turmoil, a flight to safety may reduce long-term government bond yields, resulting in a **bullish flattening** of the yield curve.

Investor Actions

In expectation of a rise (fall) in rates, investors will lower (extend) the duration of their bond portfolios. Expectations of a steepening of the yield curve may lead to investors going long short-term bonds and short longer-term bonds. Traders may design the trades to be duration-neutral so that a change in the *level* of interest rates does not affect the value of the portfolio. Investors with long-only mandates may rotate between a **bullet portfolio** (a portfolio concentrated in a single maturity) and a **barbell portfolio** (a portfolio with both short and long maturities). An investor that expects a bullish flattening of the yield curve may rotate out of a bullet portfolio and into a barbell portfolio.

THE ARBITRAGE-FREE VALUATION FRAMEWORK

Cross-Reference to CFA Institute Assigned Reading #26

There are two types of arbitrage opportunities: **value additivity** (when the value of the whole differs from the sum of the values of parts), and **dominance** (when one asset trades at a lower price than another asset with identical characteristics). If the principle of value additivity does not hold, arbitrage profits can be earned by **stripping** (buying a bond and then selling off its parts) or **reconstitution** (buying the parts to sell a reconstituted bond).

Valuation of bonds using a zero-coupon yield curve (also known as the spot rate curve) is suitable for option-free bonds. However, for bonds with embedded options where the value of the option varies with the outcome of unknown forward rates, a model that allows for variability of forward rates is necessary. One such model is the binomial interest rate tree framework.

Binomial Interest Rate Tree Framework

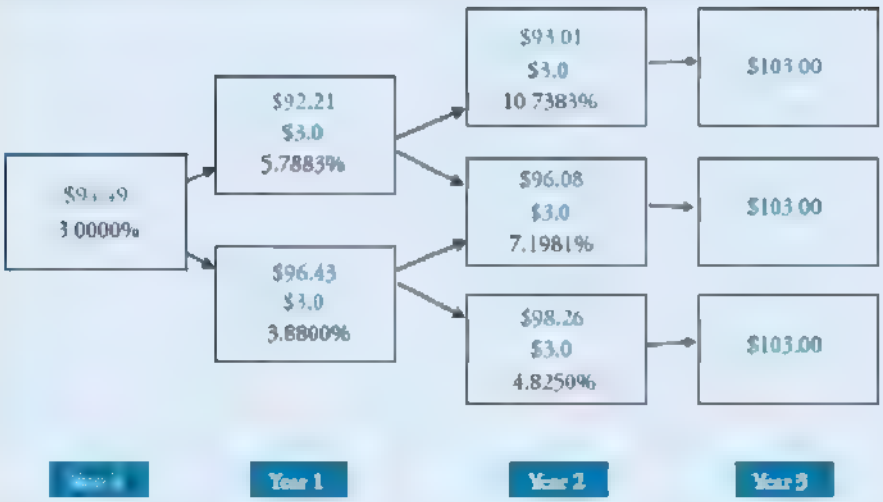
The binomial interest rate tree framework is a lognormal random walk model with two equally likely outcomes for one-period forward rates at each node. A volatility assumption drives the spread of the nodes in the tree. The tree is calibrated such that (1) the values of benchmark bonds using the tree are equal to the bonds' market prices, (2) adjacent forward rates at any nodal period are two standard deviations apart, and (3) the midpoint for each nodal period is approximately equal to the implied one-period forward rate for that period.

Backward induction is the process of valuing a bond using a binomial interest rate tree. The term *backward* is used because in order to determine the value of a bond at Node 0, we need to know the values that the bond can take on at nodal period 1, and so on.

> **EXAMPLE: Valuation of option-free bond using binomial tree**
>
> Samuel Favre is interested in valuing a three-year, 3% annual-pay Treasury bond. Favre wants to use a binomial interest rate tree with the following rates:
>
> **One-Period Forward Rate in Year**

0	1	2
3%	5.7883%	10.7383%
	3.8800%	7.1981%
		4.8250%

Compute the value of the $100 par option-free bond.



Answer:

$$V_{2,UU} = \frac{103}{(1.107383)} = \$93.01$$

$$V_{2,UL} = \frac{103}{(1.071981)} = \$96.08$$

$$V_{2,LL} = \frac{103}{(1.048250)} = \$98.26$$

$$V_{1,U} = \frac{1}{2} \times \left[\frac{93.01 + 3}{1.057883} + \frac{96.08 + 3}{1.057883}\right] = \$92.21$$

$$V_{1,L} = \frac{1}{2} \times \left[\frac{96.08 + 3}{1.038800} + \frac{98.26 + 3}{1.038800}\right] = \$96.43$$

$$V_0 = \frac{1}{2} \times \left[\frac{92.21 + 3}{1.03} + \frac{96.43 + 3}{1.03}\right] = \$94.485$$

Pathwise Valuation in a Binomial Interest Rate Framework

In the pathwise valuation approach, the value of the bond is simply the average of the values of the bond at each path. For an n-period binomial tree, there are $2^{(n-1)}$ possible paths.

Monte Carlo Forward-Rate Simulation

The Monte Carlo simulation method uses pathwise valuation and a large number of randomly generated simulated paths. Mortgage-backed securities (MBS) have path-dependent cash flows due to their embedded prepayment option. The Monte Carlo simulation method should be used for valuing MBS as the binomial tree backwards-induction process is inappropriate for securities with path-dependent cash flows.

Term Structure Models

Three categories of term structure models that describe the statistical properties of interest rate movements are:

1. **Equilibrium term structure models.**
   - **Cox-Ingersoll-Ross (CIR) model.** Assumes the economy has a natural long-run interest rate (b) that the short-term rate (r) converges to.

$$dr = a(b - r)\,dt + \sigma\sqrt{r}\,dz$$

   - **Vasicek model.** Similar to the CIR model but assumes that interest rate volatility level is independent of the level of short-term interest rates.

$$dr = a(b - r)dt + \sigma dz$$

2. **Arbitrage-free models.**
   - **Ho-Lee model.** Calibrated by using market prices to find the time-dependent drift term θ_t that generates the *current* term structure.

$$dr_t = \theta_t dt + \sigma dz$$

   - **Kalotay-Williams-Fabozzi (KWF) model.** Also assumes constant volatility and a constant drift, but assumes that the short rate follows a lognormal distribution.

$$d\ln(r_t) = \theta_t dt + \sigma dz$$

3. **Other models.**

   Gauss+ is a multifactor model that incorporates short-, medium-, and long-term rates, where the long-term rate depends on macroeconomic variables and is designed to be mean reverting. Medium-term rates revert to the long-term rate, while the short-term rate lacks a random component—consistent with the role of the central bank controlling the short-term rate.

VALUATION AND ANALYSIS OF BONDS WITH EMBEDDED OPTIONS

Cross-Reference to CFA Institute Assigned Reading #27

This topic review extends the arbitrage-free valuation framework to valuation of bonds with embedded options.

Embedded Call and Put Options

Value of an option embedded in a callable or putable bond:

$$V_{call} = V_{straight} - V_{callable}$$
$$V_{put} = V_{putable} - V_{straight}$$

Valuing a Bond with Embedded Options Using Backward Induction

EXAMPLE: Valuation of call and put options

Consider a two-year, 7% annual-pay, $100 par bond callable in one year at $100. Also consider a two-year, 7% annual-pay, $100 par bond putable in one year at $100.

The interest rate tree at 15% assumed volatility is as follows.

Value the embedded call and put options.

Answer:

Value of the straight (option-free) bond:

Consider the value of the bond at the *upper* node for Period 1, $V_{1,U}$:

$$V_{1,U} = \frac{1}{2} \times \left[\frac{\$100 + \$7}{1.071826} + \frac{\$100 + \$7}{1.071826} \right] = \$99.830$$

Similarly, the value of the bond at the *lower* node for Period 1, $V_{1,L}$, is:

$$V_{1,L} = \frac{1}{2} \times \left[\frac{\$100 + \$7}{1.053210} + \frac{\$100 + \$7}{1.053210} \right] = \$101.594$$

Now calculate V_0, the current value of the bond at Node 0.

$$V_0 = \frac{1}{2} \times \left[\frac{\$99.830 + \$7}{1.045749} + \frac{\$101.594 + \$7}{1.045749} \right] = \$102.999$$

The completed binomial tree is shown below:

Valuing a Two-Year, 7.0% Coupon, Option-Free Bond

Value of the callable bond:

The call rule (call the bond if the price exceeds $100) is reflected in the boxes in the completed binomial tree, where the second line of the boxes at the one-year node is the lower of the call price or the computed value. For example, the value of the bond in one year at the lower node is $101.594. However, in this case, the bond will be called, and the investor will only receive $100. Therefore, for valuation purposes, the value of the bond in one year at this node is $100.

$V_{1,L} = \$100$

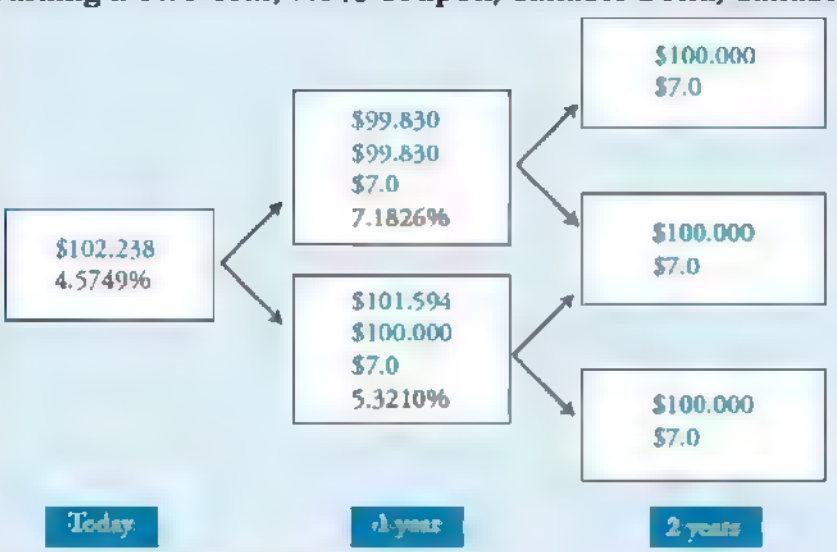
$V_{1,U} = (107 / 1.071826) = \$99.830$

The calculation for the current value of the bond at Node 0 (today), assuming the simplified call rules of this example, is:

$$V_0 = \frac{1}{2} \times \left[\frac{\$99.830 + \$7}{1.045749} + \frac{\$100\,00 + \$7}{1.045749} \right] = \$102.238$$

The completed binomial tree is shown below:

Valuing a Two-Year, 7.0% Coupon, Callable Bond, Callable in One Year at 100



Value of the putable bond:

Similarly, for a putable bond, the put rule is to put the bond if the value falls below \$100. The put option would therefore be exercised at the upper-node in year 1 and hence the \$99.830 computed value is replaced by the exercise price of \$100.

$V_{1,U} = 100$

$V_{1,L} = (107 / 1.053210) = \$101.594$

$$V_0 = \frac{1}{2} \times \left[\frac{100 + 7}{1.045749} + \frac{101.594 + 7}{1.045749}\right] = \$103.081$$

Value of the embedded options:

$V_{call} = V_{straight} - V_{callable} = \$102.999 - \$102.238 = \$0.76$

$V_{put} = V_{putable} - V_{straight} = \$103.081 - \$102.999 = 0.082$

Impact on Values

When interest rate volatility increases, the value of both call and put options on bonds increase. As volatility increases, the value of a callable bond decreases (remember that the investor is *short* the call option) and the value of a putable bond increases (remember that the investor is *long* the put option).

The short call in a callable bond limits the investor's upside when rates decrease, while the long put in a putable bond hedges the investor against rate increases.

The value of the call option will be lower in an environment with an upward-sloping yield curve because the probability of the option going in the money is low. A call option gains value when the upward-sloping yield curve flattens. Conversely, a put option will have a higher probability of going in the money when the yield curve is upward sloping; the option loses value if the upward-sloping yield curve flattens.

Option-Adjusted Spreads

The option-adjusted spread (OAS) is the constant spread added to each forward rate in a benchmark binomial interest rate tree, such that the sum of the present values of a credit risky bond's cash flows equals its market price. (The actual computation of OAS is an iterative process outside the scope of the curriculum.)

Binomial trees generated under an assumption of high interest rate volatility will lead to higher values for a call option and a corresponding lower value for a callable bond. Under a high volatility assumption, we would already have a lower computed value for the callable bond and, hence, the additional spread (i.e., the OAS) needed to force the discounted value to equal the market price will be lower.

When an analyst uses a lower-than-actual (higher-than-actual) level of volatility, the *computed* OAS for a *callable* bond will be too high (too low) and the callable bond will be erroneously classified as underpriced (overpriced).

Similarly, when the analyst uses a lower-than-actual (higher-than-actual) level of volatility, the *computed* OAS for a *putable* bond will be too low (high) and the putable bond will be erroneously classified as overpriced (underpriced).

Effective Duration

$$\text{effective duration} = \text{ED} = \frac{BV_{-\Delta y} - BV_{+\Delta y}}{2 \times BV_0 \times \Delta y}$$

effective duration (callable/putable) ≤ effective duration (straight)

effective duration (zero) ≈ maturity of the bond

effective duration of floater ≈ time in years to next reset

Interest Rate Sensitivity of Bonds with Embedded Options

For bonds with embedded options, one-sided durations—durations when interest rates rise versus when they fall—are better at capturing interest rate sensitivity than regular effective durations. When the underlying option is at- or near-the-money, callable (putable) bonds will have lower (higher) one-sided down-duration than one-sided up-duration.

Callable bonds with low coupon rates are unlikely to be called and, hence, their maturity-matched rate is their most critical rate (and will be the highest key rate duration).

As the coupon rate increases, a callable bond is more likely to be called, and the time-to-exercise rate will start dominating the time-to-maturity rate.

Putable bonds with high coupon rates are unlikely to be put and are most sensitive to its maturity-matched rate. As the coupon rate decreases, a putable bond is more likely to be put and the time-to-exercise rate will start dominating the time-to-maturity rate.

Effective Convexities of Callable, Putable, and Straight Bonds

Straight and putable bonds exhibit positive convexity throughout. Callable bonds also exhibit positive convexity when rates are high. However, at lower rates, callable bonds exhibit negative convexity.

Capped and Floored Floating-Rate Bonds

A capped floater contains an embedded option that prevents the coupon rate from rising above a specified maximum (cap) rate.

value of a capped floater = value of straight floater – value of embedded cap

A floored floater contains an embedded option that prevents the coupon rate from falling below a specified minimum (floor) rate.

value of a floored floater = value of straight floater + value of embedded floor

Defining Features of a Convertible Bond

The owner of a **convertible bond** can exchange the bond for the common shares of the issuer; it includes an embedded call option giving the bondholder the right to buy the common stock of the issuer.

Components of a Convertible Bond's Value

The conversion ratio is the number of common shares for which a convertible bond can be exchanged.

$$\text{conversion value} = \text{market price of stock} \times \text{conversion ratio}$$

$$\text{market conversion price} = \frac{\text{market price of convertible bond}}{\text{conversion ratio}}$$

$$\text{market conversion premium per share} = \text{market conversion price} - \text{market price}$$

The minimum value at which a convertible bond trades is its straight value or its conversion value, whichever is greater.

Valuing a Convertible Bond in an Arbitrage-Free Framework

The value of a bond with embedded options can be calculated as the value of the straight bond plus (minus) the value of options that the investor is long (short).

$$\begin{aligned}\text{callable and putable convertible bond value} &- \text{straight value of bond} \\ &+ \text{value of call option on stock} \\ &- \text{value of call option on bond} \\ &+ \text{value of put option on bond}\end{aligned}$$

Risk–Return Characteristics of a Convertible Bond

- The major benefit from investing in convertible bonds is the price appreciation resulting from an increase in the value of the common stock.
- The main drawback of investing in a convertible bond versus investing directly in the stock is that when the stock price rises, the bond will underperform the stock because of the conversion premium of the bond.
- If the stock price remains stable, the return on the bond may exceed the stock returns due to the coupon payments received from the bond.
- If the stock price falls, the straight value of the bond limits downside risk (assuming bond yields remain stable).

CREDIT ANALYSIS MODELS

Cross-Reference to CFA Institute Assigned Reading #28

Credit Risk Measures

The **expected exposure** is the amount of money a bond investor in a credit risky bond stands to lose at a point in time *before* any recovery is factored in. **Recovery rate** is the percentage recovered in the event of a default. **Loss given default (LGD)** is equal to loss severity (1 – recovery rate) multiplied by exposure. **Probability of default** is the likelihood of default occurring in a given year. The risk-neutral probability of default is the probability of default implied in the current market price of a risky bond.

Probability of survival is 1 – the cumulative conditional probability of default. **Credit valuation adjustment (CVA)** is the sum of the present value of the expected loss for each period; it is the difference in value between a risk-free bond and an otherwise identical risky bond.

While comparing the credit risk of several bonds, the metric that combines the probability of default as well as loss severity is the expected loss. Everything else constant, for a given period, the higher the expected loss, the higher the credit risk.

Credit Scoring and Credit Ratings

Credit scoring is used for small businesses and individuals. Credit ratings are issued for corporate debt, asset-backed securities, and government and quasi-government debt. Similar to credit scores, credit ratings are ordinal ratings (higher = better).

Credit Migration

Bond portfolio managers often want to evaluate the performance of a bond in the event of credit migration (i.e., change in rating).

$$\Delta\%P = -(\text{modified duration of the bond}) \times (\Delta \text{ spread})$$

Structural and Reduced Form Models

Structural models of corporate credit risk are based on the structure of a company's balance sheet and rely on insights provided by option pricing theory. Stock of a company with risky debt outstanding can be viewed as a call option on the company's assets. If the value of the assets exceeds the face value of the debt, the shareholders receive the residual after paying the debt investors. If, on the other hand, the assets are insufficient to cover the face value of the debt, the value of the stock is zero (due to limited liability).

$$\text{value of stock}_T = \max[A_T - K, 0] \text{ and}$$

$$\text{value of debt}_T = \min[K, A_T]$$

where:
A_T = value of company's assets at maturity of debt (at t = T)
K = face value of debt

Debt investors can also be thought of as being short a put option on company assets; when the assets are insufficient to cover the face value of debt, shareholders can exercise the put option to sell the assets at face value to pay off the debt.

value of risky debt = value of risk-free debt – value of a put option on the company's assets

Hence, the value of the put option = CVA.

While structural models provide an economic rationale for default and use insights from option pricing models, their utility is limited when companies don't have a simple balance sheet (e.g., off-balance-sheet liabilities). Further, the assumption that company assets trade is unrealistic, making the inputs into the structural model difficult to estimate.

Unlike the structural model, **reduced form (RF) models** do not explain *why* default occurs. Instead, they statistically model *when* default occurs. Default under the RF model is a randomly occurring *exogenous* variable: the **default intensity**, which is the probability of default over the next (small) time period. Default intensity can be estimated using regression models incorporating both company specific as well as macro-economic variables.

While RF models do not explain why default occurs, they do not assume that the company assets trade. A key advantage of RF models is that the default intensity is allowed to vary as company fundamentals change as well as when the state of the economy changes. However, default is treated as a random event (i.e., a surprise); but in reality, default is rarely a surprise (i.e., it is often preceded by several downgrades).

Term Structure of Credit Spread

Credit spread on a risky bond = YTM of risky bond – YTM of benchmark

The term structure of credit spreads shows the relationship between credit spreads and maturity. The shape of the term structure of credit spread depends on market's expectation of default probabilities and recovery rates over time.

The shape of the term structure is influenced by:

- Quality (higher rated segments have flatter credit spread curve);
- Overall economic conditions (spreads narrow during economic expansions and widen during cyclical downturns);
- Market demand and supply; and
- Equity market volatility.

Securitized Debt

Securitized debt entails financing of specific assets (e.g., auto loans, credit card receivables, mortgages) usually via a bankruptcy-remote SPE. Analysis of securitized debt includes analysis of collateral pool, servicer quality, and structure (distribution waterfall). A special structure is the case of a **covered bond**. Issued by a financial institution, covered bonds are senior, secured bonds backed by a collateral pool as well as by the issuer (i.e., covered bond investors have recourse rights).

CREDIT DEFAULT SWAPS

Cross-Reference to CFA Institute Assigned Reading #29

Credit Default Swaps

A **credit default swap (CDS)** is a contract between two parties in which one party purchases protection from the other party against losses from the default of a borrower. If a credit event occurs, the *credit protection buyer* gets compensated by the *credit protection seller*. To obtain this coverage, the protection buyer pays the seller a premium called the *CDS spread*. The protection seller is assuming (i.e., long) credit risk, while the protection buyer is short credit risk.

The payoff on a single-name CDS is based on the market value of the *cheapest-to-deliver* (CTD) bond that has the same seniority as the reference obligation. Upon default, a single-name CDS is terminated.

An **index CDS** covers an equally weighted combination of borrowers. When one of the index constituents defaults, there is a payoff and the notional principal is adjusted downward.

CDS Pricing

The factors that influence the pricing (i.e., spread) of CDS include the probability of default, the loss given default, and the coupon rate on the swap. The conditional probability of default (i.e., the probability of default given that default has not already occurred) is called the hazard rate.

$$\text{expected loss}_t = (\text{hazard rate})_t \times (\text{loss given default})_t$$

If the coupon payment on the swap is not set to be equal to the credit spread of the reference obligation, an upfront payment from one of the counterparties to the other is necessary.

$$\text{upfront payment (by protection buyer)} = \text{PV(protection leg)} - \text{PV(premium leg)}$$

or

$$\text{upfront premium} \approx (\text{CDS spread} - \text{CDS coupon}) \times \text{CDS duration}$$

After inception of the swap, the value of the CDS changes as the spread changes.

$$\text{profit for protection buyer (\%)} \approx \text{change in spread (\%)} \times \text{CDS duration}$$

CDS Uses

In a naked CDS, an investor with no exposure to the underlying purchases protection in the CDS market. In a long/short trade, an investor purchases protection on one reference entity while selling protection on another reference entity.

A curve trade is a type of long/short trade where the investor is buying and selling protection on the same reference entity but with different maturities. An investor who believes the short-term outlook for the reference entity is better than the long-term outlook can use a curve-steepening trade (buying protection in a long-term CDS and selling protection in a short-term CDS) to profit if the credit curve steepens. Conversely, an investor who is bearish about the reference entity's prospects in the short term will enter into a curve-flattening trade.

DERIVATIVES

Topic Weight on Exam	5%–10%
SchweserNotes™ Reference	Book 4, Pages 133–205

PRICING AND VALUATION OF FORWARD COMMITMENTS

Cross-Reference to CFA Institute Assigned Reading #30

A clear understanding of the sources and timing of forward contract settlement payments will enable you to be successful on this portion of the exam without depending on pure memorization of these complex formulas.

Pricing vs. Valuation of Forward Contracts

- The *price* of a forward contract is the price specified in the contract at which the long and short sides have agreed to trade the underlying asset when the contract expires.
- The *value* of a forward contract to each side is the amount of money the counterparty would be willing to pay (or receive) to terminate the contract. It's a zero-sum game, so the value of the long position is equal to the negative of the value of the short position.
- The *no-arbitrage* price of the forward contract (with a maturity of T years) is the price at which the value of the long side and the value of the short side are both equal to zero.

  $$FP = S_0 \times (1 + R_f)^T$$

The value of the long position in a forward contract at initiation, during the contract life, and at maturity are shown in Figure 1.

Figure 1: Forward Value of Long Position at Initiation, During the Contract Life, and at Expiration

Time	Forward Contract Valuation (Long Position)
At initiation	Zero, because the contract is priced to prevent arbitrage
During the life of the contract	$S_t - \left[\frac{FP}{(1 + R_f)^{T-t}}\right]$
At expiration	$S_T - FP$

The value of the short position at any point in time is the negative of the long position.

Forward Contract on a Stock

A stock, a stock portfolio, or an equity index may have expected dividend payments over the life of the contract. To price such a contract, we must either adjust the spot price for the present value of the expected dividends (PVD) or adjust the forward price for the future value of the dividends (FVD):

$$FP \text{ (on a stock)} = (S_0 - PVD) \times (1 + R_f)^T = [(S_0 \times (1 + R_f)^T] - FVD$$

To calculate the *value* of the long position in a forward contract on a dividend-paying stock, we make the adjustment for the present value of the remaining expected discrete dividends at time t (PVD_t) to get:

$$V_t(\text{long position on a stock}) = (S_t - PVD_t) - \left(\frac{FP}{(1 + R_f)^{T-t}}\right)$$

Forwards on Fixed Income Securities

To calculate the no-arbitrage forward price and value on a coupon-paying bond, substitute the present value of the expected coupon payments (PVC) *over the life of the contract* for the present value of the expected dividends to get:

$$FP(\text{on fixed income security}) = (S_0 - PVC) \times (1 + R_f)^T$$

$$V_t(\text{long position on fixed income security}) =$$

$$(S_t - PVC_t) - \left[\frac{FP}{(1 + R_f)^{T-t}}\right]$$

Futures Contracts on Fixed Income Securities

In a futures contract, the short may have delivery options (to decide which bond to deliver). In such a case, the quoted futures price (QFP) is adjusted using the conversion factor for the cheapest-to-deliver bond:

$$QFP = FP/CF = \left[(\text{full price})\left(1 + R_f\right)^T - FVC - AI_T\right]\left(\frac{1}{CF}\right)$$

where:
FP = futures price
full price = clean price + accrued interest at t = 0
AI_T = accrued interest at maturity of the futures contract

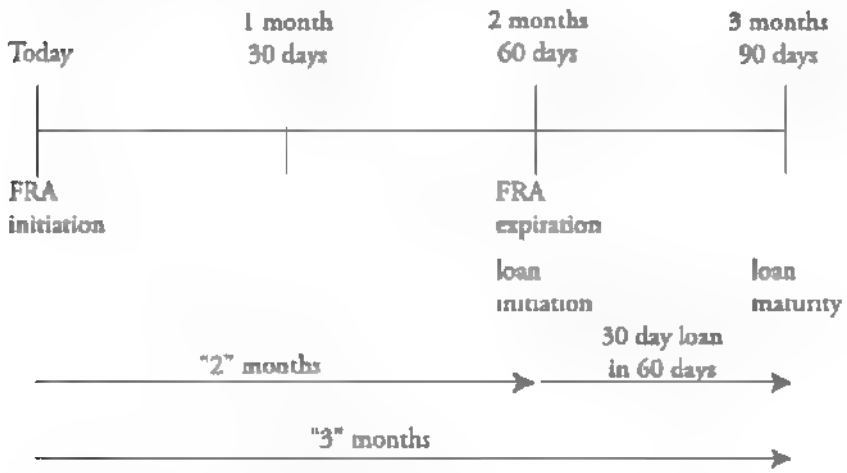
Forward Rate Agreements (FRAs)

Basics of FRAs:

- The long position in an FRA is the party that would borrow money (long the loan, with the contract price being the interest rate on the loan).
- If MRR at expiration is above the rate specified in the forward agreement, the long position in the contract can be viewed as the right to borrow at below market rates, and the long will receive a payment.

- If MRR at the expiration date is below the FRA rate, the short will receive a cash payment from the long. (The right to lend at *above* market rates has a positive value.)
- The notation for FRAs is unique. For example, a 2×3 FRA is a contract that expires in two months (60 days), and the underlying loan is settled in three months (90 days). The underlying rate is 1-month (30-day) MRR on a 30-day loan in 60 days. A timeline for a 2×3 FRA is shown in Figure 2.

Figure 2: Illustration of a 2×3 FRA



Pricing an FRA

The "price" of the FRA is actually the forward interest rate implied by the spot rates consistent with the FRA. For example, the "price" of the 2×3 FRA is the 30-day forward rate in 60 days implied by the 60- and 90-day spot rates.

Valuing an FRA

The value of an FRA to the long or short position comes from the interest savings on a loan to be made at the settlement date. This value is to be received at the end of the loan, so the value of an FRA after initiation is the present value of these savings. Remember, if the rate in the future is less than the FRA rate, the long is "obligated to borrow" at above-market rates and will have to make a payment to the short. If the market interest rate is greater than the FRA rate, the long will receive a payment from the short.

Let's outline the general steps for valuing a 2×3 FRA (a 30-day loan in 60 days) 40 days after initiation (which means there are 20 days remaining until the FRA expires).

Step 1: Calculate the implied *30-day forward rate* at the settlement date, 20 days from now, using the current 20-day spot rate and the current 50-day spot rate.

Step 2: Calculate the value of the FRA at maturity as the notional principal times the difference between the forward rate from step 1 and the original FRA "price." Make sure to convert from an annual rate to a 30-day rate. If the current forward rate is greater than the original FRA price, the long position has positive value. If the current forward rate is less than the original FRA price, the short position has positive value.

Step 3: Calculate the value of the FRA today by discounting the value at maturity from step 2 at the 50-day spot rate.

Pricing vs. Valuation of Swaps

The distinction between pricing and valuing **swaps** is the same as it is for forward contracts:

- The price of a plain-vanilla swap, for example, is the fixed rate (the swap rate) that makes the present value of the fixed-rate payments equal to the present value of the floating-rate payments. Assuming the fixed rate is set to this rate, the value of the swap to both parties at initiation of the swap is zero.
- After initiation, interest rates change and the present value of the payments on both sides of the plain vanilla swap change. The value of the swap to either party after initiation is the present value of the payments that party will receive, less the present value of the payments it will make. Because the swap is a derivative instrument, the total value to both sides must be zero, which means this is a zero-sum game, and the value of one side is the negative of the value of the other side.

Swaps as Combinations of Other Instruments

There is a simple bond transaction that is equivalent to a plain vanilla *interest rate swap.* The fixed payer could gain identical exposure by issuing a fixed-coupon bond and investing the proceeds in a floating rate bond with the same maturity and payment dates. On each payment date, a fixed coupon payment is paid, and the floating rate payment is received.

An *equity swap*, from the perspective of the fixed payer, is equivalent to borrowing at a fixed rate and investing in a stock, a portfolio, or an index. The equivalence is not exact, but close enough as an explanation of the capital markets transactions to approximate the exposure of an equity/fixed swap.

The exposure of a *currency swap* is equivalent to that of issuing a bond in one currency, exchanging the proceeds for another currency at the spot exchange rate, and purchasing a bond denominated in the other currency with the same payment and maturity dates.

Pricing and Valuing a Plain Vanilla Interest Rate Swap

We can price a plain vanilla (fixed-for-floating) interest rate swap by using the insight that the swap is equivalent to issuing a fixed-rate bond and buying an otherwise identical floating rate note. The fixed rate (the swap rate) must be set so that the values of the "replicating" floating-rate bond and the "replicating" fixed-rate bond are the same at swap initiation.

The initial annual **swap fixed rate** on a swap with N settlement periods can be calculated as:

$$\text{SFR} = \left(\frac{1 - Z_N}{Z_1 + Z_2 + \ldots + Z_N}\right) \times \text{number of settlement periods per year}$$

where:

Z_N – present value of \$1 to be received on the nth payment date, of N dates

At any payment date, the value of a plain vanilla interest rate swap (to the fixed-rate payer) is the present value of the difference in swap payments based on the new swap rate (i.e., based on the current MRR term structure) versus based on the original fixed rate.

$$\text{value to the payer} = \sum Z \times (\text{SFR}_{\text{New}} - \text{SFR}_{\text{Old}}) \times \frac{\text{days}}{360} \times \text{notional principal}$$

Pricing and Valuing a Currency Swap

Pricing a currency swap (i.e., determining the swap fixed rate in a currency swap) is accomplished using the same procedure as for interest rate swaps, except that now we have to deal with two term structures (one in each currency) and two swap rates.

For example, in a fixed-for-fixed currency swap where one side pays U.S. dollars fixed and the other side pays euros fixed, the U.S. dollar fixed rate is determined using the term structure of U.S. dollar rates, and the euro fixed rate is determined from the term structure of euro rates.

Valuing a currency swap requires us to value the cash flows for each side of the swap, the value to each party is then calculated as the value of the payments it receives less the value of the payments it makes. However, there is the complicating factor of dealing with two different currencies and an exchange rate between the two currencies that changes over time.

Let's use the fixed-for-fixed U.S. dollar-euro swap as an example to illustrate the procedure, assuming we are valuing the swap in U.S. dollars.

- Given the notional principal of the swap in dollars, convert to euros using the exchange rate at the initiation of the swap. The notional principal in dollars is the face value of the replicating U.S. dollar denominated bond; the notional principal in euros is the face value of the replicating euro denominated bond.
- After the initiation of the swap, value the U.S. dollar-denominated bond in U.S. dollars and the euro-denominated bond in euros as present value of the remaining cash flows, including the notional. Note that PV = DF × cash flow.
- Convert the value of the euro denominated bond into U.S. dollars using the exchange rate in effect on *the date the swap is being valued* (which will most likely be different than the original rate used to calculate the notional principals).
- Calculate the value of the swap to each party as the difference between the U.S. dollar values of the two bonds. For example, the value of the swap to the party paying U.S. dollars is the value of the euro-denominated bond (in U.S. dollars) minus the value of the U.S. dollar-denominated bond (in U.S. dollars).

Equity Swaps

The fixed-rate side of an equity swap is priced and valued just like an interest rate swap. To value an equity swap, value the fixed-rate side as the present value of remaining fixed-rate payments (recall that PV = DF × cash flow), plus the present value of the notional. The equity side can be valued by multiplying the notional amount of the contract times one plus the percentage equity appreciation since the last payment date. Use the difference in values to value the swap.

VALUATION OF CONTINGENT CLAIMS

Cross-Reference to CFA Institute Assigned Reading #31

Put-Call Parity for European Options

Put-call parity must hold by arbitrage:

$$C_0 + \left[\frac{X}{(1+R_f)^T}\right] = P_0 + S_0$$

Use put-call parity to create *synthetic instruments*. Interpret "+" as a long position and "–" as a short position:

synthetic call = put + stock – riskless discount bond

synthetic put = call – stock + riskless discount bond

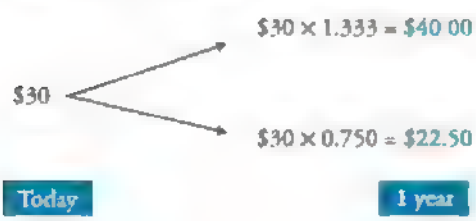
The Binomial Option Pricing Model (OPM)

The binomial process generates stock price paths, just as the binomial interest rate model generates interest rate paths. We can calculate the value of an option on the stock by:

- Calculating the payoff of the option at maturity in both the up-move and down-move states.
- Calculating the expected value of the option in one year as the probability-weighted average of the payoffs in each state.
- Discounting the expected value back to today at the risk-free rate.

Let's calculate the *value* today of a 1-period call option on a stock with an exercise price of $30. Suppose the risk-free rate is 7%, the current value of the stock is $30, the size of an up-move (U) is 1.333, and the size of down-move (D) is 0.75 (i.e., % down = 25%), as shown in Figure 3.

Figure 3: 1-Period Binomial Tree



The risk-neutral probability of an upward movement is:

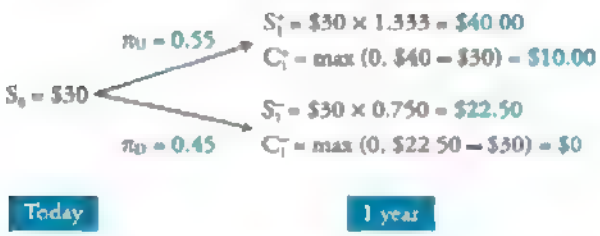
$$\pi_U = \frac{1 + R_f - D}{U - D} = \frac{1.07 - 0.75}{1.333 - 0.75} = 0.55$$

The risk-neutral probability of a downward movement is then:

$$\pi_D = 1 - \pi_U = 1 - 0.55 = 0.45$$

The binomial tree for the stock and the option is shown in Figure 4.

Figure 4: 1-Period Call Option With X = $30



The call option is in-the-money in the "up" state, and its terminal value there is $10. It is out-of-the-money in the "down" state, so its terminal value there is zero.

The expected value of the option in one year is:

$$(\$10 \times 0.55) + (\$0 \times 0.45) = \$5.50$$

The present value of the call option's expected value today is:

$$c = \frac{\$5.50}{1.07} = \$5.14$$

Interest Rate Options

Interest rate options can be valued similarly given an interest rate tree. The risk-neutral probabilities of up and down state are equal (i.e., 0.5) in an interest rate tree. The expected values of payoffs at expiration are discounted using the rates in the tree (discount rates vary for interest rate options).

The Black-Scholes-Merton Option Pricing Model Assumptions and Limitations

The *assumptions* underlying the Black-Scholes-Merton (BSM) model are:

- The price on the underlying asset follows a **lognormal** distribution and the price change is smooth.
- The (continuous) risk-free rate is constant and known.
- The volatility and yield of the underlying asset is constant and known.
- Markets are frictionless.
- The options are European.

Key Interpretations of Black-Scholes Merton Model

1. Calls can be viewed as a leveraged investment in $N(d_1)$ worth of stock for every $e^{-rT}N(d_2)$ worth of borrowed funds.

2. Puts can be viewed as long $N(-d_2)$ worth of bond for every short position in $N(-d_1)$ value of stock.
3. $N(d_2)$ is the risk-neutral probability of a call option expiring in-the-money. Similarly $N(-d_2)$ is the risk-neutral probability that a put option will expire in-the-money.
4. For dividend paying stocks, the carry benefit (dividend yield) on the underlying stock offsets the cost of carry (risk-free rate) and reduces (increases) the value of the call (put) option on the stock.
5. For options on currencies, the interest rate earned on the foreign currency is the carry benefit.

Options on Futures (Black Model)

The value of a call option on futures is equal to the value of a portfolio with a long futures position (the PV of the futures price multiplied by $N(d_1)$) and a short bond position (the PV of the exercise price multiplied by $N(d_2)$). The value of a put option is equal to the value of a portfolio with a long bond and a short futures position.

Equivalencies in Interest Rate Derivative Contracts

Combinations of interest rate options can be used to replicate other contracts, for example:

1. A long interest rate call and a short interest rate put (with exercise rate = current FRA) can be used to replicate a long FRA (i.e., a forward contract to receive a floating rate and pay-fixed).
2. Similarly, if exercise rate = the current FRA rate, a short interest rate call and long interest rate put can be combined to replicate a short FRA position (i.e., a pay-floating, receive-fixed forward contract).
3. A series of interest rate call options with different maturities and the same exercise price can be combined to form an interest rate cap. (Each of the call options in an interest rate cap is known as a caplet.) A floating rate loan can be hedged using a long interest rate cap.
4. Similarly, an interest rate floor is a portfolio of interest rate put options, and each of these puts is known as a floorlet. Floors can be used to hedge a long position in a floating rate bond.
5. If the exercise rate on a cap and floor is same, a long cap and short floor can be used to replicate a payer swap. Similarly, a short cap and long floor can replicate a receiver swap.
6. If the exercise rate on a floor and a cap are set equal to a market swap fixed rate, the value of the cap will be equal to the value of the floor.

Swaptions

A *payer swaption* is the right to enter into a specific swap at some date in the future as the fixed-rate payer at a rate specified in the swaption. If swap fixed rates increase (as interest rates increase), the right to enter the pay-fixed side of a swap (a payer swaption) becomes more valuable.

A *receiver swaption* is the right to enter into a specific swap at some date in the future as the floating-rate payer at a rate specified in the swaption. A receiver swaption becomes more valuable if rates decrease.

A portfolio containing a long (short) receiver swaption and a short (long) payer swaption (with the same exercise rates) can replicate a receiver (payer) forward swap. A callable bond can be replicated by a portfolio of a straight bond and a short receiver swaption.

Inputs to the Black-Scholes-Merton Model

There are five inputs to the BSM model: asset price, exercise price, asset price volatility, time to expiration, and the risk-free rate. The effects of changes in each input (in isolation, holding all else constant) on the value of European call and put options (on assets with no cash flows) are outlined in Figure 5.

Figure 5: BSM Sensitivities

Sensitivity Factor ("Greek")	Input	Calls	Puts
Delta	Asset price (S)	Positively related delta > 0	Negatively related delta < 0
Gamma	Delta	Positive (gamma > 0)	Positive (gamma > 0)
Vega	Volatility (σ)	Positively related vega > 0	Positively related vega > 0
Rho	Risk free rate (r)	Positively related rho > 0	Negatively related rho < 0
Theta	Time to expiration (T)	Value → $0 as call → maturity theta < 0	Value usually → 0 as put → maturity theta < 0*
	Exercise price (X)	Negatively related	Positively related

* There is an exception to the general rule that European put option thetas are negative. The put value may increase as the option approaches maturity if the option is deep in the money and close to maturity.

Delta

An option's *delta* estimates the change in the value of the option for a 1-unit change in the value of the underlying stock. From the BSM, a call option's delta is $e^{-\delta T}N(d_1)$; the comparable put option's delta is $-e^{-\delta T}N(-d_1)$.

Delta-Neutral Hedging

A *delta-neutral portfolio* combines short call options with the underlying stock so that the value of the portfolio doesn't change when the value of the stock changes. The number of call options to sell to create the delta-neutral hedge is as follows:

$$\text{number of call options needed to delta hedge} = \frac{\text{number of shares hedged}}{\text{delta of call option}}$$

The delta-neutral position only holds for very small changes in the value of the underlying stock. Hence, the delta-neutral portfolio must be continuously rebalanced to maintain the hedge. Thus it is called a dynamic hedge.

Gamma

Gamma measures the rate of change in delta as the underlying stock price changes. Gamma can be viewed as a measure of how poorly a dynamic hedge will perform when it is not rebalanced in response to a change in the asset price. Gamma risk arises when the change in stock price is abrupt rather than smooth (a violation of one of the assumptions of BSM). When that occurs, an otherwise delta-hedged portfolio will no longer be perfectly hedged.

Implied Volatility in Options Trading

Implied volatility is the volatility that, when used in the Black-Scholes formula, produces the current market price of the option. If an option is overvalued, implied volatility is too high.

ALTERNATIVE INVESTMENTS

Topic Weight on Exam	5%–10%
SchweserNotes™ Reference	Book 4, Pages 207–310

REAL ESTATE INVESTMENTS

Cross-Reference to CFA Institute Assigned Reading #32

Real Estate Investments

Figure 1 shows types of real estate investments.

Figure 1: Basic Forms of Real Estate Investment

	Debt	Equity
Private	Mortgages	Direct investments such as sole ownership, partnerships, and commingled funds
Public	Mortgage-backed securities	Shares of REITs and REOCs

Reasons to Invest in Real Estate and Risks of Investing

Reasons to invest in real estate include generation of current income and capital appreciation, as an inflation hedge, for portfolio diversification, and for tax benefits.

Principal risks of investing in real estate include the influence of business conditions on valuation, lead time in developing new property, cost and availability of capital, unexpected inflation, influence of demographic factors, lack of liquidity, environmental issues, lack of information, need for management expertise, and the use of leverage.

Real Estate Valuation

Appraisers use three different approaches to value real estate: the cost approach, the income approach, and the sales comparison approach.

1. The Cost Approach to Valuation

Under the *cost approach*, a value is derived by adding the value of the land to the current replacement cost of a new building less adjustments for estimated depreciation and obsolescence. The steps involved with applying the cost approach are:

1. Estimate the market value of the land.
2. Estimate the building's replacement cost.
3. Deduct depreciation for physical deterioration, defects, and any locational obsolescence.

The cost approach is most useful (1) when the subject property is relatively new, (2) for unusual properties, or (3) for properties where comparable transactions are limited.

2. The Income Approach to Valuation

The *income approach* includes two different valuation methods: the **direct capitalization method** and the **discounted cash flow method**. With the *direct capitalization method*, value is based on capitalizing the first-year net operating income (NOI) of the property using a *capitalization (cap) rate*. With the *discounted cash flow method*, value is based on the present value of the property's future cash flows using an appropriate discount rate.

Net operating income (NOI) is the amount of income remaining after subtracting vacancy and collection losses, as well as operating expenses such as insurance, property taxes, utilities, maintenance, and repairs, from potential gross income. NOI is calculated *before* subtracting financing costs and income taxes.

If the NOI and value are expected to grow at a constant rate, the cap rate is lower than the discount rate:

$$\text{cap rate} = \text{discount rate} - \text{growth rate}$$

Cap rate is used to capitalize first-year NOI as follows:

$$\text{value} = V_0 = \frac{NOI_1}{\text{cap rate}}$$

Cap rate can also be estimated from comparables:

$$\text{cap rate} = \frac{NOI_1}{\text{comparable sales price}}$$

EXAMPLE: Valuation using the direct capitalization method

Suppose the net operating income of an office building is expected to be $175,000 and the cap rate is 8%. **Estimate** the market value of the property using the direct capitalization method.

Answer:

The estimated market value is:

$$V_0 = \frac{NOI_1}{\text{cap rate}} = \frac{\$175{,}000}{8\%} = \$2{,}187{,}500$$

The **gross income multiplier**, another form of direct capitalization, is the ratio of the sales price to the property's expected gross income in the year after purchase. The gross income multiplier can be derived from comparable transactions.

$$\text{gross income multiplier} = \frac{\text{sales price}}{\text{gross income}}$$

Once we obtain the gross income multiplier, value is estimated as a multiple of a subject property's estimated gross income as follows:

$$\text{value} = \text{gross income} \times \text{gross income multiplier}$$

Using the discounted cash flow (DCF) method, investors usually project NOI for a specific holding period, plus the property value at the end of the holding period (i.e., terminal value). Terminal value can be estimated by capitalizing future NOI at a future cap rate known as the *terminal* or *residual cap rate.* The terminal cap rate may be different from the *"going-in"* (initial) *cap rate.*

When tenants are required to pay all expenses, a cap rate may be applied to rent instead of to NOI. The cap rate that results from dividing rent by comparable sales is called the *all risks yield* (ARY).

3. The Sales Comparison Approach to Valuation

Under the *sales comparison approach*, the sales prices of similar (comparable) properties are adjusted for differences from the subject property. The differences may relate to size, age, location, property condition, and market conditions at the time of sale. The values of comparable transactions are adjusted upward (downward) for undesirable (desirable) differences with the subject property.

Financial Ratios in Real Estate Lending/Investing

Lenders often use the *debt service coverage ratio* (DSCR) and the *loan-to-value* (LTV) ratio to determine the maximum loan amount on a specific property. The maximum loan amount is based on the measure that results in the lowest debt.

The DSCR is calculated as follows:

$$\text{DSCR} = \frac{\text{first year NOI}}{\text{debt services}}$$

The LTV ratio is calculated as follows:

$$\text{LTV} = \frac{\text{loan amount}}{\text{appraised value}}$$

When debt is used to finance real estate, equity investors often calculate the *equity dividend rate*, also known as the cash-on-cash return, which measures the cash return on the amount of cash invested.

$$\text{equity dividend rate} = \frac{\text{first year cash flow}}{\text{equity}}$$

The equity dividend rate only covers one period. It is not the same as the IRR that measures the return over the entire holding period.

Publicly Traded Real Estate Investments

Publicly traded real estate securities can take several forms. The main types are real estate investment trusts (REITs), real estate operating companies (REOCs), and residential or commercial mortgage-backed securities (MBS).

Advantages/Disadvantages of Investing in Publicly Traded Real Estate Securities vs. Direct Investment

- Advantages of investing in publicly traded real estate securities include superior liquidity, transparency, lower minimum investment, access to premium properties,

active professional management, protections afforded to publicly traded securities, and greater diversification potential.

- Advantages of investing in REITs (but not REOCs) include exemption from corporate taxation, predictable earnings, and higher yield.
- Disadvantages of investing in publicly traded real estate securities include lower tax efficiency compared to direct ownership, lack of control, costs of a publicly traded corporate structure, volatility associated with market pricing, limited potential for income growth, forced equity issuance, and structural conflicts of interests.

Approaches to REIT Valuation

1. **Net asset value per share:** NAVPS is based on market values and is considered to be the fundamental measure of value for REITs and REOCs.

   NAVPS is the (per share) amount by which assets exceed liabilities, using current market values rather than accounting book values. The current market values for real estate assets are measured by capitalizing NOI (as discussed earlier) or by using a multiple. The market values of other assets and liabilities are assumed to be equal to their book values.
2. **Relative value:** REITs and REOCs can be valued using market-based approaches by applying a multiple to a property's *funds from operations* (FFO) or *adjusted funds from operations* (AFFO).
3. **Funds from operations:** FFO adjusts reported earnings and is a popular measure of the continuing operating income of a REIT or REOC. FFO is calculated as follows:

   accounting net earnings
   + depreciation charges (expenses)
   − gains (losses) from sales of property
   = funds from operations (FFO)

   Price-to-FFO approach:

   funds from operations (FFO)
   ÷ shares outstanding
   = FFO / share
   × sector average P/FFO multiple
   = NAV / share

   Adjusted funds from operations: AFFO is an extension of FFO that is intended to be a more useful representation of current economic income.

   FFO (funds from operations)
   − non-cash (straight-line) rent adjustment
   − recurring maintenance-type capital expenditures and leasing commissions
   = AFFO (adjusted funds from operations)

   AFFO is considered a better measure of economic income than FFO because AFFO considers the capital expenditures that are required to sustain the property's economic income. However, FFO is more frequently cited in practice because AFFO relies more on estimates and is considered more subjective.

Price-to-AFFO approach:

funds from operations (FFO)
– non-cash rents
– recurring maintenance-type capital expenditures
= AFFO
÷ shares outstanding
= AFFO / share
× property subsector average P/AFFO multiple
= NAV / share

Discounted cash flow: Dividend discount models typically include two or three stages, based on near- and long-term growth forecasts. Discounted cash flow models use intermediate-term cash flow projections, plus a terminal value based on historical cash flow multiples.

value of a REIT share = PV(dividends for years 1 through n)
+ PV(terminal value at the end of year n)

PRIVATE EQUITY INVESTMENTS

Cross-Reference to CFA Institute Assigned Reading #33

Sources of Value Creation

Private equity firms add greater value to their portfolio companies compared to publicly governed firms. The sources of this increased value are thought to come from the following:

1. The ability to re-engineer the firm and operate it more efficiently.
2. The ability to obtain debt financing on more advantageous terms.
3. Superior alignment of interests between management and private equity ownership.

Control Mechanisms

Private equity firms use a variety of mechanisms to align their interests with those of the managers of portfolio companies. The following contract terms are contained in the term sheet that specifies the terms of the private equity firm's investment:

- *Compensation.* Managers of the portfolio companies receive compensation that is closely linked to the firm's performance.
- *Tag-along, drag-along clauses.* Any time an acquirer acquires control of the company, they must extend the acquisition offer to all shareholders, including firm management.

The term sheet also contains the following provisions that protect the private equity firm by providing it greater control and equity, some of which are triggered by specific events:

- *Board representation.* The private equity firm is ensured control through board representation if the firm experiences a major event such as a takeover, restructuring, initial public offering (IPO), bankruptcy, or liquidation.

- *Noncompete clauses.* Company founders must sign such clauses that prevent them from competing against the firm for a prespecified period of time.
- *Priority in claims.* Private equity firms receive their distributions before other owners, often in the form of preferred dividends. They also have priority on the firm's assets if the portfolio company is liquidated.
- *Required approvals.* Changes of strategic importance (e.g., acquisitions, divestitures, and changes in the business plan) must be approved by the private equity firm.
- *Earn-outs.* These are used predominantly in venture capital investments and tie the acquisition price paid by the private equity firm to the portfolio company's future performance over a specific period.

Appropriate control mechanisms in the investment contract allow private equity firms to make investments in companies of considerable risk.

Figure 2: Valuation Characteristics of Venture Capital and Buyout Investments

Characteristic	Venture Capital Investments	Buyout Investments
Cash Flows	Low predictability with potentially unrealistic projections	Stable and predictable cash flows
Product Market	New product market with uncertain future	Strong market position, with a possible niche position
Products	Product is based on new technology with uncertain prospects	Established products
Asset Base	Weak	Substantial base that can serve as collateral
Management Team	New team although individual members typically have a strong entrepreneurial record	Strong and experienced
Financial Leverage	Low debt use with a majority of equity financing	High amounts of debt with a large percentage of senior debt and substantial amounts of junior and mezzanine debt
Risk Assessment	Risk is difficult to measure due to new technologies, markets, and firm history	Risk can be measured due to industry and firm maturity
Exit	Exit via IPO or firm sale is difficult to forecast	Exit is predictable
Operations	High cash burn rate required due to firm and product immaturity	Potential exists for reduction in inefficiencies
Working Capital Required	Increasing requirements due to growth	Low requirements
Due Diligence Performed by Private Equity Firms	Private equity firms investigate technological and commercial prospects; investigation of financials is limited due to short history	Private equity firms perform extensive due diligence

Characteristic	Venture Capital Investments	Buyout Investments
Goal Setting	Goals are milestones set in business plan and growth strategy	Goals reference cash flows, strategic plan, and business plan
Private Equity Investment Returns	High returns come from a few highly successful investments with write-offs from less successful investments	Low variability in the success of investments with failures being rare
Capital Market Presence	Generally not active in capital markets	Active in capital markets
Sales Transactions	Most firms are sold as a result of the relationship between venture capital firm and entrepreneurs	Firms are typically sold in an auction-type process
Ability to grow through subsequent funding	Firms are less scalable as subsequent funding is typically smaller	Strong performers can increase subsequent funding amounts
Source of general partner's variable revenue	Carried interest is most common, transaction and monitoring fees are less common	Carried interest, transaction fees, and monitoring fees

Figure 3: Valuation Issues for Buyouts vs. Venture Capital Investments

Valuation Issue	Venture Capital	Buyout
Applicability of DCF Method	Less frequently used as cash flows are uncertain	Frequently used to estimate value of equity
Applicability of Relative Value Approach	Difficult to use because there may be no true comparable firms	Used to check the value from DCF analysis
Use of Debt	Low as equity is dominant form of financing	High
Key Drivers of Equity Return	Pre-money valuation, investment, and subsequent dilution	Earnings growth, increase in multiple upon exit, and reduction in the debt

Valuation Characteristics of Venture Capital vs. Buyout

There are four typical **exit routes** for private equity firms: (1) initial public offerings (IPOs), (2) secondary market sales, (3) management buyouts (MBOs), and (4) liquidations.

The general **private equity risk factors** include liquidity risk, unquoted investments risk, competitive environment risk, agency risk, capital risk, regulatory risk, tax risk, valuation risk, diversification risk and market risk.

The **costs of investing in private equity** are significantly higher than with publicly traded securities and include transaction costs, investment vehicle fund setup costs,

administrative costs, audit costs, management and performance costs, dilution costs, and placement fees.

Important **economic terms of a private equity fund** include management, transaction fees, carried interest, ratchet, hurdle rate, target fund size, vintage, and the term of the fund.

The **corporate governance terms** in the prospectus provide the legal arrangements for the control of the fund and include key man clauses, performance disclosure and confidentiality, clawback, distribution waterfall, tag-along, drag-along clauses, removal for cause, no-fault divorce, investment restrictions, and co-investment.

The VC Method

The VC method makes use of an ROI (return on investment) multiple that incorporates the risk of the investment.

ROI = value of equity at exit / post-money valuation

ROI is used to determine the post-money valuation (the value of the start-up immediately after the investment by the VC fund) as follows:

POST = exit value / ROI

fractional ownership of the VC investors = f = investment / POST

number of shares allocated to VC investors = shares allocated to founders × [f / (1 – f)]

price per share = investment / # of shares allocated to VC investors

dilution (for first-round investors) after the second round = $f_1 \times (1 - f_2)$

Quantitative Measures

The more popular multiples and those specified by GIPS include the following:

- **PIC (paid-in capital).** The percent of committed or absolute amount of capital utilized by the GP to date.
- **DPI (distributed to paid-in capital).** The cumulative distributions paid to the LPs divided by the cumulative invested capital. It is net of management fees and carried interest and is also referred to as the cash-on-cash return.
- **RVPI (residual value to paid-in capital).** This measures the LP's unrealized return and is the value of the LP's holdings in the fund divided by the cumulative invested capital. It is net of management fees and carried interest.
- **TVPI (total value to paid-in capital).** This measures the LP's realized and unrealized return and is the sum of DPI and RVPI. It is net of management fees and carried interest.

INTRODUCTION TO COMMODITIES AND COMMODITY DERIVATIVES

Cross-Reference to CFA Institute Assigned Reading #34

Characteristics of Commodity Sectors

Commodity sectors include energy (crude oil, natural gas, and refined petroleum products), industrial metals (aluminum, nickel, zinc, lead, tin, iron, and copper), grains (wheat, corn, soybeans, and rice), livestock (hogs, sheep, cattle, and poultry), precious metals (gold, silver, and platinum), and softs or cash crops (coffee, sugar, cocoa, and cotton).

Crude oil must be refined into usable products but may be shipped and stored in its natural form. Natural gas may be used in its natural form but must be liquefied to be shipped overseas.

Industrial and precious metals have demand that is sensitive to business cycles and typically can be stored for long periods.

Production of grains and softs is sensitive to weather. Livestock supply is sensitive to the price of feed grains.

Commodity Sector Life Cycles

The life cycle of commodity sectors includes the time it takes to produce, transport, store, and process the commodities.

- Crude oil production involves drilling a well and extracting and transporting the oil. Oil is typically stored for only a short period before being refined into products that will be transported to consumers.
- Natural gas requires little processing and may be transported to consumers by pipeline.
- Metals are produced by mining and smelting ore, which requires producers to construct large-scale fixed plants and purchase equipment. Most metals can be stored long term.
- Livestock production cycles vary with the size of the animal. Meat can be frozen for shipment and storage.
- Grain production is seasonal, but grains can be stored after harvest. Growing seasons are opposite in the northern and southern hemispheres.
- Softs are produced in warm climates and have production cycles and storage needs that vary by product.

Valuation of Commodities

In contrast to equities and bonds, which are valued by estimating the present value of their future cash flows, commodities do not produce periodic cash inflows. While the spot price of a commodity may be viewed as the estimated present value of its future selling price, storage costs (i.e., cash outflows) may result in forward prices that are higher than spot prices.

Contango and Backwardation

Basis is the difference between the spot price and a futures price for a commodity. Calendar spread is the difference between futures prices for a longer-term contract

versus a near-term contract.

A market is in contango if futures prices are greater than spot prices, and in backwardation if futures prices are less than spot prices. Calendar spreads and basis are negative in contango and positive in backwardation.

Theories of Futures Returns

Insurance theory states that futures returns compensate contract buyers for providing protection against price risk to futures contract sellers (i.e., the producers). This theory implies that backwardation is a normal condition.

The **hedging pressure hypothesis** expands on insurance theory by including long hedgers as well as short hedgers. This theory suggests futures markets will be in backwardation when short hedgers dominate (i.e., too many hedgers are short) and in contango when long hedgers dominate.

The **theory of storage** states that spot and futures prices are related through storage costs and convenience yield.

Total Return of a Fully Collateralized Commodity Futures Contract

The total return on a fully collateralized long futures position consists of collateral return, price return, and roll return. Collateral return is the yield on securities the investor deposits as collateral for the futures position. Price return or spot yield is produced by a change in spot prices.

$$\text{price return} = \frac{(\text{current spot price} - \text{previous spot price})}{\text{previous spot price}}$$

Roll return results from closing out expiring contracts and reestablishing the position in longer-dated contracts.

$$\text{roll return} = \frac{\text{price of expiring futures contract} - \text{price of new futures contract}}{\text{price of expiring futures contract}}$$

Roll Return in Contango and Backwardation

Roll return is positive when a futures market is in backwardation because a long position holder will be buying longer-dated contracts that are priced lower than the expiring contracts. Roll return is negative when a futures market is in contango because the longer-dated contracts are priced higher than the expiring contracts.

Adjusting Exposure to Commodities Using Commodity Swaps

Investors can use swaps to increase or decrease exposure to commodities. In a total return swap, the variable payments are based on the change in price of a commodity. In an excess return swap, the variable payments are based on the difference between a commodity price and a benchmark value. In a basis swap, the variable payments are based on the difference in prices of two commodities. In a commodity volatility swap, the variable payments are based on the volatility of a commodity price.

Impact of Index Construction on Commodity Index Returns

Returns on a commodity index are affected by how the index is constructed. The index components and weighting method affect which commodities have the greatest influence on the index return. The methodology for rolling over expiring contracts may be passive or active. Frequent rebalancing of portfolio weights may decrease index returns in trending markets or increase index returns in choppy or mean-reverting markets.

PORTFOLIO MANAGEMENT

Topic Weight on Exam	10%–15%
SchweserNotes™ Reference	Book 5, Pages 1–132

EXCHANGE-TRADED FUNDS: MECHANICS AND APPLICATIONS

Cross-Reference to CFA Institute Assigned Reading #35

Creation/Redemption Process of ETFs and the Function of Authorized Participants

Authorized participants (APs) can create additional shares by delivering the **creation basket** to the ETF manager. **Redemption** is similarly conducted by tendering ETF shares and receiving the redemption basket. These primary market transactions are in-kind and require a service fee payable to the ETF issuer, shielding the nontransacting shareholders from the costs and tax consequences of creation/redemption. The creation/redemption process ensures that market prices of ETF shares stay within a narrow band of its NAV.

How ETFs Are Traded in Secondary Markets

ETFs are traded just like other shares on the secondary markets. Market fragmentation may widen the quoted spreads for European ETFs.

Sources of Tracking Error for ETFs

Tracking error is the annualized standard deviation of the daily tracking difference. Sources of tracking error include fees and expenses of the fund, sampling and optimization used by the fund, the fund's investment in depository receipts (as opposed to the underlying shares directly), changes in the index, regulatory and tax requirements, fund accounting practices, and asset manager operations.

Factors Affecting ETF Bid-Ask Spreads

ETF **spreads** are positively related to the cost of creation/redemption, the spread on the underlying securities, the risk premium for carrying trades until close of trade, and the APs' normal profit margin. ETF spreads are negatively related to the probability of completing an offsetting trade on the secondary market. Creation/redemption fees and other trading costs can influence spreads as well.

Sources of ETF Premiums and Discounts to NAV

ETF premium (discount) % = (ETF price – NAV) / NAV

Sources of premium or discount include timing difference for ETFs with foreign securities traded in different time zones, and stale pricing for infrequently traded ETFs.

Costs of Owning an ETF

ETF costs include trading cost and management fees. Short-term investors focus on lower trading costs while longer-term, buy-and-hold investors seek lower management fees. Trading costs tend to be lower for more liquid ETFs. Liquidity is evaluated using the ratio of average dollar volume to average assets (higher is better).

Types of ETF Risk

Risks of investing in ETFs include **counterparty risk** (common for ETNs), fund closures, and expectation-related risk.

Portfolio Uses of ETFs

Portfolio uses of ETFs include:

- Efficient portfolio management, including liquidity management, portfolio rebalancing, portfolio completion, and transition management.
- Asset class exposure management, including core exposure to an asset class or sub-asset class as well as tactical strategies.
- Active investing, including smart beta, risk management, alternatively weighted ETFs, discretionary active ETFs, and dynamic asset allocation.

USING MULTIFACTOR MODELS

Cross-Reference to CFA Institute Assigned Reading #36

Arbitrage Pricing Theory (APT):

The APT describes the equilibrium relationship between expected returns for well-diversified portfolios and their multiple sources of systematic risk.

Underlying Assumptions of the APT

The APT makes only three key assumptions:

1. Unsystematic risk can be diversified away in a portfolio.
2. Returns are generated using a factor model.
3. No arbitrage opportunities exist.

Arbitrage Opportunities

An arbitrage opportunity is defined as an investment opportunity that bears no risk and has no cost, but provides a profit. Arbitrage is conducted by forming long and short portfolios; the proceeds of the short sale are used to purchase the long portfolio.

Additionally, the factor sensitivities (betas) of the long and short portfolios are identical and, hence, our net exposure to systematic risk is zero. The difference in

returns on the long and short portfolios is the arbitrage return.

Expected Return Versus Factor Sensitivities and Factor Risk Premiums

expected return = risk-free rate + Σ(factor sensitivity) × (factor risk premium)

Macroeconomic Factor Models, Fundamental Factor Models, and Statistical Factor Models

A multifactor model is an extension of the one-factor market model; in a multifactor model, asset returns are a function of more than one factor. There are three types of multifactor models:

1. **Macroeconomic factor models** assume that asset returns are explained by surprises (or shocks) in macroeconomic risk factors (e.g., GDP, interest rates, and inflation). Factor surprises are defined as the difference between the realized value of the factor and its consensus expected value.
2. **Fundamental factor models** assume asset returns are explained by the returns from multiple firm-specific factors (e.g., P/E ratio, market cap, leverage ratio, and earnings growth rate).
3. **Statistical factor models** use multivariate statistics (factor analysis or principal components) to identify statistical factors that explain the covariation among asset returns. The major weakness is that the statistical factors may not lend themselves well to economic interpretation.

Sources of Active Risk

Active return is the difference between portfolio and benchmark returns ($R_P - R_B$), and active risk is the standard deviation of active return over time. Active risk is determined by the manager's active factor tilt and active asset selection decisions:

active risk squared = active factor risk + active specific risk

Tracking Risk and the Information Ratio

The **information ratio** is active return divided by active risk:

$$IR = \frac{\bar{R}_P - \bar{R}_B}{\sigma_{(R_P - R_B)}}$$

Multifactor Models' Uses and Output

Multifactor models can be useful for risk and return attribution and for portfolio composition. In return attribution, the difference between an active portfolio's return and the benchmark return is allocated between factor return and security selection return.

$$\text{factor return} = \sum_{i=1}^{k} (\beta_{pk} - \beta_{bk}) \times (\lambda^k)$$

In risk attribution, the sum of the active factor risk and active specific risk is equal to active risk squared (which is the variance of active returns):

$$\text{active risk squared} = \text{active factor risk} + \text{active specific risk}$$

$$\text{active specific risk} = \sum_{i=1}^{n} \left(W_{pi} - W_{bi}\right)^2 \sigma_{\varepsilon i}^2$$

$$\text{active factor risk} = \text{active risk squared} - \text{active specific risk}$$

Multifactor models can also be useful for portfolio construction. Passive managers can invest in a tracking portfolio, while active managers can go long or short factor portfolios.

A **factor portfolio** is a portfolio with a factor sensitivity of 1 to a particular factor and 0 to all other factors. It represents a pure bet on a single factor and can be used for speculation or hedging purposes. A **tracking portfolio** is a portfolio with a specific set of factor sensitivities. Tracking portfolios are often designed to replicate the factor exposures of a benchmark index like the S&P 500.

Considering Multiple Risk Dimensions in Modeling Asset Returns

Multifactor models enable investors to zero in on risks that the investor has a comparative advantage in bearing and avoid the risks that the investor does not have comparative advantage in.

Multifactor models are superior to single factor models like CAPM when the underlying asset returns are better described by multifactor models.

MEASURING AND MANAGING MARKET RISK

Cross-Reference to CFA Institute Assigned Reading #37

Using VaR to Measure Portfolio Risk

Value at risk (VaR) is an estimate of the minimum loss that will occur with a given probability over a specified period, expressed as a currency amount or as percentage of portfolio value.

Methods of Estimating VaR

Value at risk estimation methods include the following:

- **Parametric method.** Uses the estimated variances and covariances of portfolio securities to estimate the distribution of possible portfolio values, often assuming a normal distribution.
- **Historical simulation.** Uses historical values for risk factors over some prior lookback period to get a distribution of possible values.
- **Monte Carlo simulation.** Draws each risk factor change from an assumed distribution and calculates portfolio values based on a set of changes in risk factors; repeated thousands of times to get a distribution of possible portfolio values.

Estimating and Interpreting VaR

The x% of VaR is calculated as the minimum loss for the current portfolio, x% of the time, based on an estimated distribution of portfolio values.

Advantages and Limitations of VaR

Advantages of VaR:

- Widely accepted by regulators.
- Simple to understand.
- Expresses risk as a single number.
- Useful for comparing the risk of portfolios, portfolio components, and business units.

Disadvantages of VaR:

- Subjective, in that the time period and the probability are chosen by the user.
- Very sensitive to the estimation method and assumptions employed by the user.
- Focuses only on left-tail outcomes.
- Vulnerable to misspecification by the user.

Extensions of VaR

Conditional VaR (CVaR) is the expected loss given that the loss exceeds VaR.

Incremental VaR (IVaR) is the estimated change in VaR from a specific change in the size of a portfolio position.

Marginal VaR (MVaR) is the estimate of the change in VaR for a small change in a portfolio position and is used as an estimate of the position's contribution to overall VaR.

Ex-ante tracking error, also referred to as **relative VaR**, measures the VaR of the difference between the return on a portfolio and the return on the manager's benchmark portfolio.

Sensitivity and Scenario Risk Measures vs. VaR

Sensitivity analysis is used to estimate the change in a security or portfolio value to an incremental change in a risk factor.

Scenario analysis refers to estimation of the effect on portfolio value of a specific set of changes in relevant risk factors.

A scenario of changes in risk factors can be historical (based on a past set of risk factors of changes that actually occurred) or hypothetical (based on a selected set of significant changes in the risk factors of interest).

Managing Market and Volatility Risk Using Options Exposure Measures

Equity risk is measured by beta (sensitivity to overall market returns).

The interest rate risk of fixed-income securities is measured by **duration** (sensitivity to change in yield) and **convexity** (a second-order effect, change in duration).

Options risk is measured by delta (sensitivity to asset price changes), gamma (a second-order effect, change in delta), and vega (sensitivity to asset price volatility).

Market risk can be managed by adjusting portfolio holdings to control the exposures to these various risk factors.

Sensitivity Risk Measures and Scenario Risk Measures

A stress test based on either sensitivity or scenario analysis uses extreme changes to examine the expected effects on a portfolio or organization, often to determine the effects on a firm's equity or solvency. A reverse stress test is designed to identify scenarios that would result in business failure.

Sensitivity analysis can give a risk manager a more complete view of the vulnerability of a portfolio to a variety of risk factors. Sensitivity and scenario risk measures provide additional information about portfolio risk, but do not necessarily provide probabilities or, in the case of sensitivity measures, the sizes of expected changes in risk factors and portfolio value.

Sensitivity and scenario analyses provide information that VaR does not. Such analyses are not necessarily based on historical results. A historical scenario is unlikely to reoccur in the exact same way in the future. Hypothetical scenarios may be misspecified, and the probability that a scenario will occur is unknown.

Advantages and Limitations of Sensitivity and Scenario Risk Measures

VaR, sensitivity analysis, and scenario analysis complement each other, and a risk manager should not rely on only one of these measures.

- VaR provides a probability of loss.
- Sensitivity analysis provides estimates of the relative exposures to different risk factors, but does not provide estimates of the probability of any specific movement in risk factors.
- Scenario analysis provides information about exposure to simultaneous changes in several risk factors or changes in risk correlations, but there is no probability associated with a specific scenario.

Risk Measures Used by Various Institutions

Banks are concerned with many risks, including asset-liability mismatches, market risk for their investment portfolios, their leverage, the duration and convexity of their portfolios of fixed-income securities, and the overall risks to their economic capital.

Asset managers are most concerned with returns volatility and the probability distribution of either absolute losses or losses relative to a benchmark portfolio.

Pension fund managers are concerned with any mismatch between assets and liabilities as well as with the volatility of the surplus (assets minus liabilities).

Property and Casualty (P&C) insurance companies are concerned with the sensitivity of their investment portfolios to risk factors, the VaR of their economic capital, and scenarios that incorporate both market and insurance risks as stress tests of the firm.

Life insurers are concerned with market risks to their investment portfolio assets and liabilities (to make annuity payments), any mismatch between assets and liabilities, and scenarios that would lead to large decreases in their surplus.

Constraints Used in Managing Market Risks

Risk budgeting begins with determination of an acceptable amount of risk and then allocates this risk among investment positions to generate maximum returns for the risk taken.

Position limits are maximum currency amounts or portfolio percentages allowed for individual securities, securities of a single issuer, or classes of securities, based on their risk factor exposures.

A stop-loss limit requires that an investment position be reduced (by sale or hedging) or closed out when losses exceed a given amount over a specified time period.

A scenario limit requires adjustment of the portfolio so that the expected loss from a given scenario will not exceed a specified amount.

BACKTESTING AND SIMULATION

Cross-Reference to CFA Institute Assigned Reading #38

Backtesting

The primary goal of **backtesting** is to assess the risk and return of an investment strategy by simulating the investment process. Backtesting uses historical data to evaluate whether a particular investment strategy would have produced excess returns historically. This assessment allows an investor to optimize their investment process and strategy.

Steps in Backtesting a Strategy

The three steps in backtesting an investment strategy are:

1. Strategy design.
   a. Specify the investment hypothesis and goals.
   b. Determine the investment process and rules of the investment strategy.
   c. Select key parameters.
2. Historical investment simulation.
   a. For each period, assemble a portfolio according to the previously determined rules.
   b. Rebalance the portfolio over time based on those investment rules.
3. Analysis of output.
   a. Compute performance statistics, such as risk and return for the portfolio.

b. Calculate other relevant metrics, such as turnover.

In **rolling-window backtesting**, an investor makes use of a walk-forward (rolling-window) process, calibrates or fits trade signals or factors based on this rolling window, periodically rebalances the portfolio, and then evaluates portfolio performance over time. In this way, rolling-window backtesting simulates real-world investing.

Problems in Backtesting

- **Survivorship bias.** Using data that includes only the entities that have survived over time.
- **Look-ahead bias.** Using information that would have been unavailable at the time of the investment decision.
- **Data snooping.** Choosing a model based on backtesting performance (i.e., a large *t*-statistic or a small *p*-value).

Scenario Analysis and Simulation

Scenario analysis is a method for investigating the performance and risk of investment strategies under different scenarios (e.g., structural regimes such as recession vs. nonrecession, or high volatility vs. low volatility). Stress testing examines the performance of a strategy under the most adverse combinations of events and scenarios.

If asset returns do not follow a multivariate normal distribution (e.g., if they exhibit skewness or excess kurtosis), scenario analysis and simulation can provide a more complete picture of investment strategy performance. Conventional rolling-window backtesting may not fully account for the dynamic nature of financial markets or possible extreme downside risk. Scenario analysis and simulation can provide a more thorough portrayal of investment strategy performance.

Monte Carlo and Historical Simulation

Monte Carlo and historical simulation approaches are methods used to account for skewness, excess kurtosis, and tail dependence. In **historical simulation**, observations are randomly chosen from the historical dataset so that each past observation has an equal probability of being selected.

In a **Monte Carlo simulation**, a statistical distribution is specified and calibrated using historical return data.

When the assets or factors are correlated, a multivariate distribution should be used rather than modeling each asset or factor on a standalone basis.

To conduct a **sensitivity analysis**, we fit factor return data to a distribution that accounts for skewness and excess kurtosis (e.g., a multivariate skewed Student's *t*-distribution), and then repeat the Monte Carlo simulation.

ECONOMICS AND INVESTMENT MARKETS

Market Value of Assets

The value of any asset can be computed as present value of its expected future cash flows discounted at an appropriate risk-adjusted discount rate. Risky cash flows require the discount rate to be higher due to inclusion of a risk premium. Market prices reflect current expectations. Only changes in expectations cause a change in market price.

Short-Term Interest Rates

Interest rates are positively related to GDP growth rate and to the expected volatility in GDP growth due to a higher risk premium. When the economy is in recession, short-term policy rates tend to be low. Investor expectations about higher future GDP growth and inflation as the economy comes out of recession lead to higher longer-term rates. This leads to positive slope of the yield curve. Conversely, an inversely sloping yield curve is often considered a predictor of future recessions.

Yield Spreads Between Non-Inflation-Adjusted and Inflation-Indexed Bonds

> break-even inflation rate (BEI) = yield on non-inflation-indexed bonds – yield on inflation-indexed bonds

BEI is comprised of two elements: expected inflation (π) and risk premium for uncertainty in inflation (θ).

Credit Spreads

Credit spreads tend to rise during times of economic downturns and shrink during expansions. When spread narrows, lower-rated bonds tend to outperform higher-rated bonds. Spreads for issuers in the consumer cyclical sector widen considerably during economic downturns compared to spreads for issuers in the consumer non-cyclical sector.

Phase of the Business Cycle and Earnings Growth Expectations

Cyclical industries (e.g., durable goods manufacturers and consumer discretionary) tend to be extremely sensitive to the business cycle; their earnings rise during economic expansions and fall during contractions. Non-cyclical, or defensive industries, tend to have relatively stable earnings.

Consumption-Hedging Properties of Equity and the Equity Risk Premium

Equities are generally cyclical; they have higher values during good times and have poor consumption hedging properties. Therefore, the risk premium on equities should be positive.

Economic Factors Affecting Investment in Commercial Real Estate

Commercial real estate has equity-like and bond-like characteristics. The valuation depends on the rental income stream, the quality of tenants, and the terminal value at the end of the lease term. The discount rate for commercial real estate includes a risk premium for uncertainty in terminal value and also for illiquidity.

ANALYSIS OF ACTIVE PORTFOLIO MANAGEMENT

Cross-Reference to CFA Institute Assigned Reading #40

Value Added by Active Management

value added = active return = active portfolio return − benchmark return

active return = $\sum(\Delta w_i) \times$ (return of security i)

Active return is composed of two parts: asset allocation return plus security selection return:

$$E(R_A) = \sum w_j E(R_{B_j}) + \sum w_{P_j} E(R_{A_j})$$

where:
$E(R_{A_j})$ = expected active return within asset class j = $E(R_{P_j}) - E(R_{B_j})$
Δw_j = active weight of security j = $w_{P_j} - w_{B_j}$

Sharpe Ratio and Information Ratio

$$\text{Sharpe ratio} = SR = \frac{R_P - R_F}{\sigma_P}$$

$$\text{information ratio} = IR = \frac{R_P - R_B}{\sigma_{(R_P - R_B)}} = \frac{R_A}{\sigma_A} = \frac{\text{active return}}{\text{active risk}}$$

$$\text{unconstrained portfolio optimal active risk} = \sigma_A^* = \frac{IR}{SR_B}\sigma_B$$

The Sharpe ratio of a portfolio comprised of an optimal proportion of benchmark portfolio and active portfolio is as follows:

$$SR_P = \sqrt{SR_B^2 + IR_P^2}$$

Unlike the Sharpe ratio, the information ratio is altered by the addition of cash or use of leverage. For an unconstrained portfolio, the information ratio is unaffected by the aggressiveness of active weights.

The Fundamental Law of Active Portfolio Management

The three components of the information ratio are:

1. The information coefficient (measure of manager's skill).
2. The breadth (number of independent active bets).
3. The transfer coefficient (the degree of constraints on manager's active management).

$$IR = (TC)IC\sqrt{BR}$$

$$E(R_A) = (TC)IC\sqrt{BR}\sigma_A$$

For an unconstrained portfolio, TC = 1.

Selecting an Investment Manager and Choosing the Level of Active Portfolio Risk

An investor will always choose the active manager with the highest information ratio regardless of her risk aversion.

The investor will combine the active portfolio with the highest information ratio and the benchmark to create a portfolio with a suitable level of optimal risk based on their risk preferences.

Active Management Strategies and the Fundamental Law of Active Management

The information coefficient of a market timer = IC = 2 × (% correct) − 1.

The fundamental law can also be used to evaluate active sector rotation strategies.

Strengths and Limitations of the Fundamental Law of Active Management

While the fundamental law can be used for evaluating market timing, security selection, and sector rotation strategies, one has to be aware of its practical limitations.

The limitations of the fundamental law include bias in measurement of the ex-ante information coefficient and lack of true independence while measuring the breadth of an active strategy.

TRADING COSTS AND ELECTRONIC MARKETS

Cross-Reference to CFA Institute Assigned Reading #41

Components of Execution Costs

Explicit trading costs include brokerage, taxes, and fees. **Implicit trading costs** include the bid-ask spread, price impact, slippage, and opportunity cost.

Effective Spreads and VWAP Transaction Cost

effective spread = 2 × (per-share spread transaction cost)

VWAP transaction cost for *sell* orders
= trade size × (benchmark VWAP − trade VWAP)

VWAP transaction cost for *buy* orders
= trade size × (trade VWAP − benchmark VWAP)

The Implementation Shortfall Approach

Implementation shortfall is the difference in value between a hypothetical (or paper) portfolio in which the trade is fully executed with no cost, and the value of the actual portfolio.

The Development of Electronic Trading Systems

The factors driving the development of electronic trading systems include lower cost, higher accuracy, provision for audit trails, fraud prevention, and a continuous market during trading hours.

Market Fragmentation

Market fragmentation results when a security trades in multiple markets. Trading algorithms such as **liquidity aggregation** (i.e., creation of a "super book") and **smart order routing** seek to overcome the challenges posed by market fragmentation.

Types of Electronic Traders

Electronic traders include news traders, dealers, arbitrageurs, front runners, quote matchers, and buy-side traders.

Characteristics of Electronic Trading Systems

Latency is defined as the time lapse between the occurrence of an event and execution of a trade based on that event. Electronic trading systems allow low-latency traders to gain a competitive advantage by jumping the order queue.

Advantages of Low-Latency Traders

Electronic market traders employ **advanced orders**, **trading tactics**, and **trading algorithms**. **Electronic markets** enable **hidden orders**, **leapfrogging algorithms**, **flickering quotes**, **electronic arbitrage**, and **machine learning**.

Risks Associated With Electronic Trading

Risks of electronic trading include increased systemic risk due to **runaway algorithms**, **fat finger errors**, **overcharge orders**, and **malevolent orders**. HFT arms races disadvantage small traders.

Abusive Trading Practices

Real-time surveillance and monitoring of electronic markets seek to detect market abuses and potential crises as they unfold, allowing for a faster response.

Abusive trading practices include front running and market manipulation. Market manipulation activities include **trading for price impact**, **rumormongering**, **wash trading**, **spoofing**, **bluffing**, **gunning the market**, and **squeezing/cornering**.

ETHICAL AND PROFESSIONAL STANDARDS

Topic Weight on Exam	10%–15%
SchweserNotes™ Reference	Book 5, Pages 133–207

For many candidates, ethics is difficult material to master. Even though you are an ethical person, you will not be prepared to perform well on this portion of the Level II exam without a comprehensive knowledge of the Standards of Professional Conduct.

Up to 15% of Level II exam points come from the ethics material, so you should view this topic as an area where you can set yourself apart from the other candidates sitting for the same exam.

A STUDY PLAN FOR ETHICS

The big question is, "What do I need to know?" The answer is that you really need to be able to *apply* the ethics material. You simply must spend time learning the Standards and developing some intuition about how CFA Institute expects you to respond on the exam. Here are several quick guidelines to help in your preparation:

- *Focus on the Standards.* The Standards of Professional Conduct are the key to the ethics material. The Code of Ethics is a poetic statement of objectives, but the heart of the testing comes from the Standards.
- *Broad interpretation.* A broad definition of most standards is needed for testing purposes *even if it seems too broad to apply in your "real world" situation.* For instance, a key component of the professional standards is the concept of disclosure (e.g., disclosure of conflicts of interest, compensation plans, and soft dollar arrangements). On the exam, you need to interpret what needs to be disclosed very broadly. A good guideline is that if there is any question in your mind about whether a particular bit of information needs to be disclosed, then it most certainly needs disclosing. *Err on the side of massive disclosure!*
- *Always side with the employer.* Many view the Code and Standards to be an employer-oriented document. That is, for many readers the employer's interests seem to be more amply protected. If there is a potential conflict between the employee and employer, always side with the employer.
- *Defend the charter.* CFA Institute views itself as the guardian of the industry's reputation and, specifically, the guardian of the CFA® designation. On the exam, be very suspicious of activity that makes industry professionals and CFA charterholders look bad.
- *Assume all investors are inexperienced.* Many different scenarios can show up on the exam (e.g., a money manager contemplating a trade for a large trust fund). However, when you study this material, view the Standards from the perspective of a money manager with fiduciary responsibility for a small account belonging to inexperienced

investors. Assuming that the investors are inexperienced makes some issues more clear.

Now, how should you approach this material? There are two keys here.

- *First, you need to read the material very carefully.* We suggest that you underline key words and concepts and commit them to memory. It's probably a good idea to start your study effort with a careful read of ethics and then go over the material again in May.
- *Second, you should answer every practice ethics question you can get your hands on to develop some intuition.* The truth is that on the exam, you are going to encounter a number of ethics questions that you don't immediately know the answer to. Answering a lot of practice questions will help you develop some intuition about how CFA Institute expects you to interpret the ethical situations on the exam. Also, study every example in the official curriculum volumes and be prepared for questions on the exam that test similar concepts. While going through the solutions to these practice questions, also seek to understand why the distractors were incorrect. This will help you in situations where that choice would actually be the correct answer.

THE CODE OF ETHICS

Cross-Reference to CFA Institute Assigned Reading #42

Members of the CFA Institute and candidates for the CFA designation must:

- Act with integrity, competence, diligence, and respect, and in an ethical manner with the public, clients, prospective clients, employers, employees, colleagues in the investment profession, and other participants in the global capital markets.
- Place the integrity of the investment profession and the interests of clients above their own personal interests.
- Use reasonable care and exercise independent professional judgment when conducting investment analysis, making investment recommendations, taking investment actions, and engaging in other professional activities.
- Practice and encourage others to practice in a professional and ethical manner that will reflect credit on themselves and the profession.
- Promote the integrity and viability of the global capital markets for the ultimate benefit of society.
- Maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals.

GUIDANCE FOR STANDARDS I–VII

Cross-Reference to CFA Institute Assigned Reading #43

The following is a summary of the Standards of Professional Conduct. Focus on the purpose of the standard, applications of the standard, and proper procedures of compliance for each standard.

Standard I: Professionalism

I(A) Knowledge of the Law. Understand and comply with laws, rules, regulations, and Code and Standards of any authority governing your activities. In the event of a conflict, follow the more strict law, rule, or regulation. Do not knowingly participate or assist in violations, and dissociate from any known violation.

PROFESSOR'S NOTE

The requirement to disassociate from any violations committed by others is explicit in the Standard. This might mean resigning from the firm in extreme cases. The guidance statement also makes clear that you aren't required to report potential violations of the Code and Standards committed by other members or candidates to CFA Institute, although it is encouraged. Compliance with any applicable fiduciary duties to clients would now be covered under this standard.

I(B) Independence and Objectivity. Use reasonable care to exercise independence and objectivity in professional activities. Don't offer, solicit, or accept any gift, benefit, compensation, or consideration that would compromise either your own or someone else's independence and objectivity.

PROFESSOR'S NOTE

The prohibition against accepting gifts, benefits, compensation, or other consideration that might compromise your independence and objectivity includes all situations beyond just those involving clients and prospects, including investment banking relationships, public companies the analyst is following, pressure on sell-side analysts by buy-side clients, and issuer-paid research.

I(C) Misrepresentation. Do not knowingly misrepresent facts regarding investment analysis, recommendations, actions, or other professional activities.

PROFESSOR'S NOTE

Plagiarism is addressed under the broader category of misrepresentation.

I(D) Misconduct. Do not engage in any professional conduct that involves dishonesty, fraud, or deceit. Do not do anything that reflects poorly on your integrity, good reputation, trustworthiness, or professional competence.

PROFESSOR'S NOTE

The scope of this standard addresses only professional misconduct and not personal misconduct. There is no attempt to overreach or regulate one's personal behavior.

Standard II: Integrity of Capital Markets

II(A) Material Nonpublic Information. If you are in possession of nonpublic information that could affect an investment's value, do not act or induce someone else to act on the information.

PROFESSOR'S NOTE

This Standard addressing insider trading states that members and candidates must not act or cause others to act on material nonpublic information until that same information is made public. This is a strict standard—it does not matter whether the information is obtained in breach of a duty, is misappropriated, or relates to a tender offer. The "mosaic theory" still applies, and an analyst can take action based on her analysis of public and nonmaterial nonpublic information.

II(B) Market Manipulation. Do not engage in any practices intended to mislead market participants through distorted prices or artificially inflated trading volume.

Standard III: Duties to Clients

III(A) Loyalty, Prudence, and Care. Always act for the benefit of clients and place clients' interests before your employer's or your own interests. You must be loyal to clients, use reasonable care, and exercise prudent judgment.

PROFESSOR'S NOTE

Applicability of any fiduciary duties to clients and prospects is now covered under Standard I(A) Knowledge of the Law.

III(B) Fair Dealing. You must deal fairly and objectively with all clients and prospects when providing investment analysis, making investment recommendations, taking investment action, or in other professional activities.

PROFESSOR'S NOTE

This Standard includes providing investment analysis and engaging in other professional activities as well as disseminating investment recommendations and taking investment action.

III(C) Suitability

1. When in an advisory relationship with a client or prospect, you must:
   - Make reasonable inquiry into a client's investment experience, risk and return objectives, and constraints prior to making any recommendations or taking investment action. Reassess information and update regularly.
   - Be sure investments are suitable to a client's financial situation and consistent with client objectives before making recommendations or taking investment action.
   - Make sure investments are suitable in the context of a client's total portfolio.
2. When managing a portfolio, your investment recommendations and actions must be consistent with the stated portfolio objectives and constraints.

PROFESSOR'S NOTE

The client's written objectives and constraints are required to be reviewed and updated "regularly." The second item applies the suitability standard to

managed portfolios and requires you to stick to the mandated investment style as outlined in the portfolio objectives and constraints.

III(D) Performance Presentation. Presentations of investment performance information must be fair, accurate, and complete.

III(E) Preservation of Confidentiality. All information about current and former clients and prospects must be kept confidential unless it pertains to illegal activities, disclosure is required by law, or the client or prospect gives permission for the information to be disclosed.

PROFESSOR'S NOTE

This Standard covers all client information, not just information concerning matters within the scope of the relationship. Also note that the language specifically includes not only prospects but former clients. Confidentiality regarding employer information is covered in Standard IV.

Standard IV: Duties to Employers

IV(A) Loyalty. You must place your employer's interest before your own and must not deprive your employer of your skills and abilities, divulge confidential information, or otherwise harm your employer.

PROFESSOR'S NOTE

The phrase "in matters related to employment" means that you are not required to subordinate important personal and family obligations to your job. The Standard also addresses the issue of "whistle-blowing" by stating that there are circumstances in which the employer's interests are subordinated to actions necessary to protect the integrity of the capital markets or client interests.

IV(B) Additional Compensation Arrangements. No gifts, benefits, compensation, or consideration that may create a conflict of interest with the employer's interest are to be accepted, unless written consent is received from all parties.

PROFESSOR'S NOTE

"Compensation" includes "gifts, benefits, compensation, or consideration."

IV(C) Responsibilities of Supervisors. You must make reasonable efforts to ensure that anyone subject to their supervision or authority complies with applicable laws, rules, regulations, and the Code and Standards.

PROFESSOR'S NOTE

The focus is on establishing and implementing reasonable compliance procedures in order to meet this Standard. Notice also that informing your employer of your responsibility to abide by the Code and Standards is only a recommendation.

Standard V: Investment Analysis, Recommendations, and Actions

V(A) Diligence and Reasonable Basis

1. When analyzing investments, making recommendations, and taking investment actions, use diligence, independence, and thoroughness.
2. Investment analysis, recommendations, and actions should have a reasonable and adequate basis, supported by research and investigation.

PROFESSOR'S NOTE

This Standard explicitly requires that you exercise diligence and have a reasonable basis for investment analysis, as well as for making recommendations or taking investment action.

V(B) Communication With Clients and Prospective Clients

1. Disclose to clients and prospects the basic format and general principles of investment processes they use to analyze and select securities and construct portfolios. Promptly disclose any process changes.
2. Disclose to clients and prospective clients significant limitations and risks associated with the investment process.
3. Use reasonable judgment in identifying relevant factors important to investment analyses, recommendations, or actions, and include those factors when communicating with clients and prospects.
4. Investment analyses and recommendations should clearly differentiate facts from opinions.

PROFESSOR'S NOTE

This Standard covers communication in any form with clients and prospective clients, including research reports and recommendations.

V(C) Record Retention. Maintain all records supporting analysis, recommendations, actions, and all other investment-related communications with clients and prospects.

PROFESSOR'S NOTE

The issue of record retention is a separate Standard, emphasizing its importance. It includes records relating to investment analysis as well as investment recommendations and actions. The guidance statement says you should maintain records for seven years in the absence of other regulatory guidance.

Standard VI: Conflicts of Interest

VI(A) Disclosure of Conflicts. You must make full and fair disclosure of all matters that may impair your independence or objectivity or interfere with your duties to employer, clients, and prospects. Disclosures must be prominent, in plain language, and effectively communicate the information.

PROFESSOR'S NOTE

The emphasis is on meaningful disclosure in prominent and plain language; impenetrable legal prose that no one can understand is not sufficient.

VI(B) Priority of Transactions. Investment transactions for clients and employers must have priority over those in which you are a beneficial owner.

PROFESSOR'S NOTE

The language is intended to be clear—transactions for clients and employers always have priority over personal transactions.

VI(C) Referral Fees. You must disclose to your employers, clients, and prospects any compensation, consideration, or benefit received by, or paid to, others for recommendations of products and services.

Standard VII: Responsibilities as a CFA Institute Member or CFA Candidate

VII(A) Conduct as Participants in CFA Institute Programs. You must not engage in conduct that compromises the reputation or integrity of CFA Institute, the CFA designation, or the integrity, validity, or security of CFA Institute programs.

PROFESSOR'S NOTE

The Standard is intended to cover conduct such as cheating on the CFA exam or otherwise violating rules of CFA Institute or the CFA program. It is not intended to prevent anyone from expressing any opinions or beliefs concerning CFA Institute or the CFA program. Violations also include discussing the questions (or even broad subject areas) that were tested or not tested on the exam.

VII(B) Reference to CFA Institute, the CFA Designation, and the CFA Program. You must not misrepresent or exaggerate the meaning or implications of membership in CFA Institute, holding the CFA designation, or candidacy in the program.

PROFESSOR'S NOTE

This Standard prohibits you from engaging in any conduct that may "misrepresent or exaggerate the meaning or implications of membership in CFA Institute, holding the CFA designation, or candidacy in the CFA program." You cannot reference any "partial" designation because this also misrepresents or exaggerates credentials.

APPLICATION OF THE CODE AND STANDARDS: LEVEL II

Cross-Reference to CFA Institute Assigned Reading #44

The Code and Standards are the heart of the Level II ethics curriculum, so we recommend spending about 90% of your ethics study time on them. However, one

additional ethics topic review at Level II may be tested, specifically Reading #44 "Application of the Code and Standards: Level II." Spend the other 10% of your time on this topic.

ESSENTIAL EXAM STRATEGIES

GAME PLAN

This chapter provides important guidance about *how* to pass the Level II CFA exam. These insights and techniques will help you successfully demonstrate your hard-earned knowledge on exam day.

On the Level II exam, you are expected to demonstrate a greater depth of understanding than on the Level I exam. Furthermore, the caliber of the average Level II student is significantly higher than that of the average Level I candidate. Consequently, success at Level I is no guarantee of success at Level II.

As you probably know, CFA Institute has transitioned all CFA exams to computer-based testing. For Level II, there will be sittings in May 2023, August 2023, and November 2023.

There are some important differences between preparing for the Level II exam and the Level I exam. First, the question format will be different. The entire Level II exam will be in item set format. Item sets are short cases, usually containing various exhibits, followed by a series of (generally) four multiple choice questions about the scenario. The two exam day sessions will run for 2 hours and 12 minutes each, and you will be presented with 88 questions total over the entire exam.

We begin by showing you some proven approaches to mastering the Level II CFA curriculum. Next, we will communicate a plan for the last week before the exam. We will offer important suggestions to make sure you are prepared on exam day—that you're not so flustered by the time you begin the exam that your performance is negatively affected. We will also spend some time discussing strategies for taking the exam and for approaching individual questions.

THE PRACTICE FIELD

As you prepare for the CFA exam, try to focus on the exam itself. Don't add to your stress level by worrying about whether or not you'll pass or what might happen if you don't. Many of the tips we provide are proven exam-day stress reducers. Your grasp of the content, combined with our test-taking tips, should leave you very well prepared for the exam. You will be ready for the questions, and you will be ready for the exam experience.

All of the faculty at Kaplan Schweser have earned the CFA charter and have extensive experience teaching the topics covered in the CFA curriculum. We know what you are experiencing, and we have witnessed thousands of candidates go through the process of earning the right to use the CFA designation. Now, we want to share with you the time-honored strategies that we have personally seen lead to success on the Level II exam.

There are two fundamentals for success on the Level II exam: focus on the big picture and know the main concepts.

The Big Picture

Focusing on the big picture means you should know something about as many concepts as possible. For example, many candidates are not comfortable with pension accounting, because it seems to them like a lot of adjustments that do not make a big difference in analyzing a stock. Our advice is to learn some of the basics for the exam. For example, learn the differences between IFRS and U.S. GAAP in recognizing pension expense in income statement versus OCI. By remembering some basic information on exam day, you will be able to narrow your answer choices on an item set. You probably won't get every question correct with only a basic grasp of the concept, but you can improve your odds on a multiple-choice question from 33% to 50% by eliminating one incorrect answer choice. Also, you will be better able to discriminate between relevant and irrelevant information in a question.

Another component of the big picture focus is studying as many topics as possible. It is a poor exam strategy to ignore significant pieces of the curriculum. Some candidates believe that as long as they know a few topics very well, they can bluff their way through the rest of the exam. These may be intelligent people, but their exam strategy isn't smart.

Know the Main Concepts

By knowing the main concepts, we mean identifying the "must know" Level II subject matter. With the help of many experienced folks here at Kaplan Schweser, we have done some of that in the previous chapters of this book. These are the concepts that we think you have to know to be successful on the Level II exam. In any given year, some of these concepts might be omitted, but if you can answer every question on these concepts, you will dramatically increase your odds of passing the exam. Generally, the idea is to be correct on most of the questions on important concepts, and then rely on your "big picture" knowledge to get points on the remaining material.

Topic Weighting

In preparing for the exam, pay attention to the weights assigned to each topic in the curriculum. The topic weights are as follows:

Topic	Exam Weight
Quantitative Methods	5%–10%
Economics	5%–10%
Financial Statement Analysis	10%–15%
Corporate Issuers	5%–10%
Equity Valuation	10%–15%
Fixed Income	10%–15%
Derivatives	5%–10%
Alternative Investments	5%–10%
Portfolio Management	10%–15%
Ethical and Professional Standards	10%–15%
Total	**100%**

Formulas

At Level II, the emphasis shifts away from blindly memorizing formulas and then plugging numbers into them. Instead, you also need to know in which situations the formula can be applied appropriately and the assumptions that support it. Being able to work with formulas will be important to your exam day success, but don't focus on simply memorizing them.

RULE BOOK

At some point in your studies, we recommend that you take time to review the information in the "Candidate Resources" section of CFA Institute website (*www.cfainstitute.org*). (You will probably find this to be a nice break from accounting or derivatives!) For example, be sure that you are able arrive on exam day with a *valid* (not expired) *international travel passport*. Select an approved calculator (TI BA II Plus or HP 12C) and learn how to use it. Read the Candidate Bulletins that are issued by CFA Institute in the months before the exam, and be aware of items you can and cannot take to the exam. Testing center policies about scratch paper vary. Some centers provide blank sheets of paper while others provide dry-erase boards.

These policies *will* apply to *you*. Every year, many candidates have problems on exam day because they assume their case is a legitimate exception. There is no such thing. If you read the rules and follow them, you will reduce the potential for unexpected stress on exam day.

FINAL WARM-UPS

You should have a strategy for the last week before the exam. If possible, take at least some of the week off from work (better yet, the entire week). Save at least one mock exam (4½ hours) for this last week. To simulate the actual exam, avoid accessing this exam until you are ready to sit down and take it for the first time. Take the exam early in the week, and time yourself. Then, use the results to determine where to focus your study efforts over the last few days. You should devote much of your time to areas where you performed poorly, but spend enough time on your stronger topics to keep them fresh in your mind and keep your confidence level up.

Visit the actual exam center sometime during the week before the exam. Determine how long it will take to get there on exam day and where you can park. Even if you are returning to the same site where you took the Level I exam, be sure nothing has changed. Bring an energizing snack to consume on your optional break; sugar and caffeine are good bets for a short-term boost. The fewer surprises on exam day, the better.

Expect problems on exam day. Be prepared for things like cold or hot rooms, noise, or issues checking-in to your test center. There are some elements of the testing environment that you cannot control, but if you are prepared for them, your exam performance is less likely to be affected.

Avoid "binge" studying the evening before the exam. Relax and make a concerted effort to get a good night's sleep; tired candidates make silly mistakes. You will miss easy

points if you are not rested. This seems like a trite point, but it is difficult to overemphasize the importance of going into the exam refreshed.

CFA INSTITUTE QUESTION CONSTRUCTION GUIDELINES

CFA Institute has released very specific guidelines it uses to develop multiple choice questions. We will review the most important issues, but refer to the Candidate Resources section of the CFA Institute website (*www.cfainstitute.org*) for more detailed information.

Construction of Multiple Choice Questions

Item set questions on the Level II CFA exam consist of a several-hundred-word vignette, a stem (which can be a question, a statement, or a table), and three possible answers labeled A, B, and C. One of the three choices is the correct answer and the other two are incorrect.

The incorrect choices are carefully selected to be common errors made by candidates, so don't be lulled into a false sense of security just because your answer happens to show up among the choices.

Word Choice in Stems

CFA Institute question stems often include qualifying words such as:

- *Most likely.*
- *Least likely.*
- *Best* described.
- *Most* appropriate.
- *Most* accurate.
- *Least* appropriate.
- *Least* accurate.

Questions that require a calculation, such that the choices are numerical choices (as in our example), will generally use "closest to." If you've taken the right approach on the question, your answer will be very close to one of the choices, and not nearly as close to any of the others.

Notice that this is consistent with the idea that you should choose the "best" response among the three choices. It is possible, for example, that you could argue that two choices are "appropriate," but only one of them is "most appropriate." Don't spend your time creating unlikely scenarios where another choice might just be possible in some unusual circumstance.

CFA Institute does not use any of the following as answer choices:

- All of the above.
- None of the above.

- Cannot determine.
- Cannot calculate.
- Not enough information to determine.

How Is an Item Set (Selected Response) Different From Level I Multiple Choice?

An item set is a short story, called a vignette, followed by a series of four questions. The Level II exam will consist of 88 questions total, divided between two sessions. You will be allocated 12 minutes for each 4-subquestion item set (this is three minutes per subquestion). Remember that you must allow time to read and digest the information given. It is generally most efficient to read the first subquestion before looking at the vignette; that way you know what specific information you are looking for in the vignette.

About 30%–40% of the Level II questions will be quantitative, meaning that calculations will be required to determine the answer. The remaining questions will be qualitative, requiring knowledge of how to apply and interpret the concepts in the curriculum. Note that this can include the interpretation of numerical data that is provided for you. Don't expect the qualitative questions to be easier than the quantitative ones.

Answering a Multiple Choice Question in a Level II Item Set

Here are some tips to keep in mind as you work through item set questions:

- Do *not* judge the facts presented in the case. If part of the scenario seems unrealistic, do not twist the facts to fit your "real world" understanding of the topic. Accept the facts as given and answer the questions using the CFA curriculum.
- Read each question carefully! Watch for double negatives, like "All of the following are disadvantages except:" It is very important not to miss words by reading too quickly; for example, "most likely" instead of "least likely."
- Read *all* answer choices. Don't just stop when you get to one that sounds right; there may be a better choice or you may find that you misread the previous choice.
- After you read each question, formulate your own answer before reading the answer choices. Anticipate what you expect the answer to be.
- On calculation problems, after you select an answer choice, pause for a moment and think about whether the answer makes sense. Is the sign (positive or negative) of your answer correct? Does the direction of change make sense?
- Do not look for patterns in a series of answers. Just because the last three questions all had "C" for an answer, do not expect that the next question must be "A." There is no reason to expect that CFA Institute has any preference as to how many questions have one letter answer or another.
- Finally, *do not lose your confidence.* Nobody gets a perfect score on the CFA exam; it just does not happen. Remember, the passing score is less than 70%—that means you can answer more than 30% of questions incorrectly and still pass. Even if you begin

to struggle on a few questions (or even five or six in a row), do not lose your confidence.

What to Do With a Difficult Question in an Item Set

You will run into questions that give you trouble. You might not understand the question, you may think none of the answers make sense, or you may not know that concept. Here are some tips to follow if you find yourself facing a difficult question:

- If the question does not make sense, or if none of the answers look correct, reread the question to see if you missed something. If you are still unsure, select an answer choice and move on.
- *Never leave a question unanswered.* A skipped question has a maximum point value of zero. A randomly marked answer has an expected value of 0.33 × 3 = 1.0 point. You are not penalized for wrong answers, so it pays to guess.

Exam Duration

The Level II exam will be shorter in 2023 than exams of a few years ago, due to CFA Institute's transition to computer-based testing.

Your 2023 Level II exam day will comprise:

- Pledge, tutorial, and survey: up to ½ hour.
- Exam session 1: 2 hours and 12 minutes.
- Break: up to ½ hour (optional).
- Exam session 2: 2 hours and 12 minutes.

Testing time totals 4 hours and 24 minutes.

Plan on 5½ hours for your entire exam day experience.

Time Management: General Comments

Candidates who fail the Level II exam frequently cite time management as their biggest downfall. Here are some tips to help you manage your time wisely:

- Time yourself on at least one mock exam. This will give you some indication of whether you will have a problem with pace on exam day.
- One way to alleviate time pressure is to bank a few minutes by doing an easy topic first. You may wish to start on a topic you feel comfortable with.
- Pace yourself. Don't rush excessively, but even more importantly, be sure not to get bogged down.
- If you run into an especially long or tough question, don't dwell on it. Take an educated guess and come back to it later if time permits.

Prior to the Exam

- Check your passport to make sure it doesn't expire before exam day.
- Confirm that information on file in your CFA account is the same as that in your passport. If your name does not exactly match, you will not be permitted to take the

exam.

- Read the Testing Policies page on the CFA Institute website.
- Visit your test site before exam day to plan for travel time and parking.
- Plan to bring a high-energy snack for the optional 30-minute break.
- Get plenty of sleep the night before; don't stay up cramming.
- Review the Code and Standards the day before the exam.

Exam Day Tips

Keep the following in mind going into your test:

- The exam room might be either too hot or too cold. Layer your clothing.
- Get to the testing site early, so you are not rushed. Leave adequate time for check-in.
- Follow the instructions of the test center employees.
- Don't assume anything that is not given in the question.
- Don't jump to conclusions; read all three answer choices.
- Select an answer for every question. There is no penalty for guessing; all that counts is the number of correct answers.
- Do not let your eyes wander around the room.
- Be prepared for each exam session to end abruptly after the allocated amount of time.

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